Indian Meteorological Memoirs:

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OCCASIONAL DISCUSSIONS AND COMPILATIONS OF METEOROLOGICAL DATA

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INDIA AND THE NEIGHBOURING COUNTRIES.

and severe famines in India during the past 150 years, showing the exceptional character of the famines of 1896-97 and of 1899-1900:—

TABLE I.

Year of drought.	Area of drought.	Year of famine.	Area of famine or scarcity.	Approximate extent of famine area.	Maximum number of persons in receipt of relief.
1769	Drought in Bengal	1770	Famine in Bengal.	Not known. Probably about 100,000 square miles.	Not known.
1791	Drought in Bombay, Hyderabad and Madras.	1792	Scarcity in north part of Madras. Intense famine in Hyderabad and Southern Mahratta country. Severe famine in Deccan, Gujarat and Marwar.	200,000 square miles.	Do.
1802	Drought in South Hyderabad and in Deccan.	1803	Famine in Deccan and Hyderabad	150,000 square miles.	Do.
1803	Drought in the ceded districts of the United Provinces and in Central India.	1804	Famine in the United Provinces and scarcity in Central India and Rajputana.	100,000 square miles.	Do.
1824	Drought in Bombay	1824	Famine in the northern districts of Madras.	80,000 square miles	Do.
		1825	Scarcity in Bombay, chiefly in Gujarat and the Northern Deccan.		
1836	Drought in the United Provinces, the eastern states of Rajputana and south-eastern districts of the Punjab.	1837-38.	Intense famine in the Central Doab and Trans-Jumna districts of the United Provinces and in the Delhi and Hissar divisions of the Punjab and in parts of Rajputana.	110,000 square miles.	100,000 daily.
1860	Drought in parts of the United Provinces and Punjab and the neighbouring states of Rajputana.	1861	[illegible]	Probably about 55,000 square miles.	130,000 daily.
1865	[illegible] Western Bengal.	1866	Famine in the Ganjam and Bellary districts of Madras, Orissa (intense) and Bihar. Scarcity in the adjacent districts of Madras, in Mysore, Hyderabad and Bombay and in Central and Western Bengal.	150,000 to 200,000 square miles.	250,000 daily.
1868	Drought in Rajputana, the Trans-Jumna districts of the United Provinces, the north and south-east districts of the Central Provinces and in the Punjab.	1869	[illegible]	[illegible] square	210,000 daily.
1873	Drought in North Bihar and in part of the United Provinces of Agra and Oudh.	1874	Famine in Bihar and scarcity in the adjacent districts of the United Provinces of Agra and Oudh.	55,000 square miles.	1,500,000(?)
1876	Drought in Madras, the Deccan, Mysore and the south districts of Hyderabad.	1877	Famine in Madras, Mysore, Bombay and Hyderabad.	250,000 to 300,000 square miles.	800,000
1877	Drought in the Central Provinces, United Provinces and Punjab.	1878	Famine in United Provinces and Kashmir. Scarcity in the Punjab.	About 150,000 square miles.	200,000 nearly.
1896	Drought in the United Provinces, Central Provinces, Central India and Rajputana.	1897	Famine in United Provinces, Central Provinces and parts of Central India and Rajputana.	300,000 to 400,000 square miles.	3,000,000
1899	Drought in South Punjab, Rajputana, Central India, Berar, Central Provinces, Hyderabad, Bombay Presidency and parts of Orissa, Chota Nagpur and Madras.	1900	Famine in South Punjab, East Sind, Rajputana, Central India, Berar, Central Provinces, Deccan, Cutch, Kathiawar and Gujarat.	600,000 to 700,000 square miles.	6,500,000

A brief statement is first of all given of the meteorology of India during the period 1892-1902 as preliminary to the investigation of the meteorology of the two contrasted wet and dry periods into which the whole period may be divided.

The discussion for each of the two periods is arranged under the following heads:—

(1) More important facts of the distribution of rainfall in India and the neighbouring regions as furnished by the departmental data.

(2) The distribution of rainfall in more distant regions in as far as it determines the limits of these large general variations of rainfall.

(3) Associated meteorological phenomena in the areas of similar rainfall variation, more especially temperature, humidity, cloud, pressure, solar radiation, and ground surface temperature.

(4) Discussion of the peculiar meteorological features of the period and more especially of the relation of the distribution of the rainfall to the atmospheric circulation in the Indian Ocean.

Before giving data for the whole of India it appears to be desirable to give a single example showing the very great local variations of the rainfall and the varying intensity of the drought even in comparatively small areas in India. The area selected is a portion of the Simla hill districts, about 70 miles long and 60 miles broad.

TABLE II.

Station.	Approximate elevation.	Approximate distance in a straight line from foot of the Simla Himalayas.	Average annual rainfall.	Variation of annual rainfall in										
				Wet period.			Dry period.							
				1892.	1893.	1894.	1895.	1896	1897.	1898.	1899.	1900	1901.	1902.
	Feet.	Miles.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Kasauli .	6,335	15	58·66	+18·55	+25·98	+46·97	+ 3·88	− 1·25	+ 6·39	− 5·78	−9·50	+18·97	+12·14	− 9·38
Barauli .	...	19	45·81	+ 0·98	+ 1·63	+32·46	− 2·69	− 6·89	− 2·84	− 0·12	−17·26	+ 4·53	+42·08	−15·08
Simla .	7,224	30	65·14	− 8·35	− 6·21	+44·37	+ 1·44	−15·63	−14·16	−32·78	−23·42	− 5·82	+ 7·05	−24·78
Kotkhai .	...	52	44·72	− 6·74	− 7·04	+17·73	− 7·77	−18·54	+ 2·59	−16·92	−26·83	− 6·07	− 4·67	−17·65
Kotgarh .	...	48	46·00	−10·03	−15·51	+ 9·37	−16·84	−16·83	− 7·11	−13·72	−20·97	+ 2·22	− 5·61	−17·71
Kilba .	7,800	85	40·17	−20·53	− 9·54	+ 2·36	−14·41	−17·17	− 5·41	−31·65	−25·83	− 3·26	−13·73	−10·29

The following gives a summary of the above:—

TABLE III.

Station.	Wet period, 1892-94.		Dry period, 1895-1902.	
	Total actual variation of rainfall.	Total variation expressed as a percentage of normal fall of the period.	Total actual variation of rainfall.	Total variation expressed as a percentage of normal fall of the period.
	Inches.		Inches.	
Kasauli	+91·50	+52	− 4·53	− 1
Barauli	+35·07	+26	+ 1·63	0
Simla	+30·01	+15	− 88·15	−17
Kotkhai	+ 3·95	+ 3	− 85·87	−24
Kotgarh	−16·17	−12	− 96·57	−26
Kilba	−27·71	−23	−109·75	−34

The data are consistent and show clearly the increasing amount of the deficiency in proceeding from the first line of hills (Kasauli) to the interior at Kilba, about 60 miles up the Sutlej Valley and 30 miles from the first line of snows The deficiency at Kilba in the eight years 1895-1902 is nearly equal to three years' mean rainfall.

This example shows that it would be impossible within the compass of a memoir to discuss thoroughly all the important local variations in the distribution of the rainfall during the period over the whole of India, and hence only the broad facts of the rainfall distribution in India are considered in the present investigation.

Brief statement of the meteorology of India during the period 1892-1902.

The following gives a brief account of the chief features of the meteorology of each year of the period 1892-1902 extracted and compiled from the annual summaries (which should be consulted if fuller information be required).

1892 *The cold-weather period.*—The rainfall of this period was small in amount and considerably below the normal, more especially in Upper India. There were four disturbances in the month of January, but they were very feeble and gave little rain. The only important storm of this period crossed Northern India between the 12th and 15th of February. It gave light to moderate rain to the whole of Northern India.

The most important feature of the period was the very deficient precipitation in the hill districts of the Punjab and United Provinces where the weather was exceptionally dry, and in the plain districts of Upper India.

The hot-weather period.—This period was even drier than usual over by far the greater part of the interior. March was exceptionally dry. Assam, Lower Burma, and Tenasserim were the only areas which received occasional showers Weather was more disturbed than usual in April and May in North-Eastern and Southern India, which were visited by frequent series of thunderstorms. Assam, Tenasserim, Malabar, Mysore and South Madras received larger rainfall amounts than usual. The Cachar and Sylhet districts of Assam, and the Assam hill districts had exceptionally heavy rain in April and Assam and North Bengal heavy rain in May.

The south-west monsoon period.—The first burst of the monsoon commenced on the Malabar Coast about the 24th May. It extended to North Kanara on the 26th and Ratnagiri on the 28th. The greater part of Southern India and the Deccan received moderate rain during the last week of May.

The monsoon rains commenced on the Bombay coast on the 1st June, slightly earlier than usual, and extended very rapidly during the next week over the whole of India excepting the Punjab and West Rajputana. This advance was feeble and was followed by a prolonged break over the whole of the interior which lasted until the first week of July. The Bay current was established about the normal date in Bengal. The Bay current strengthened in the last week of June and the Bombay current in the first week of July. Both currents rapidly extended in full force over Northern and Central India, and prevailed with unusual steadiness until the last week of September. They withdrew on the 26th from North-West India. The Bengal current, as judged by the rainfall, was considerably stronger than usual during the whole period, and the Bombay current was strong and steady in the months of July and September, and feebler than usual in August. The rains were abundant in

every part of India except Burma and Bengal, where there was a slight to moderate deficiency. The rainfall was exceptionally heavy in the West Punjab and West Rajputana, the total fall of the period at many stations being considerably larger than had been previously recorded.

The retreating south-west monsoon period.—The monsoon current retreated earlier than usual from Bengal in the second week of October and the rainfall in that month was in moderate general defect in North-Eastern India and more especially in the northern districts of Bengal and Bihar and in the Assam Valley. The Bay current during the latter half of October was mainly directed to the north and central coast districts of Madras. The Deccan and the Madras coast districts hence received abnormally heavy rain during this period.

November was an abnormally dry month in Madras. A cyclonic storm which formed in the centre of the Bay on the 26th October and following days, advanced northward and gave a much needed burst of rain to the greater part of Bengal on the 1st, 2nd and 3rd. Light local showers of little agricultural value were received during the first and last weeks of November in the central and southern districts of Madras. The total rainfall of the month in eight of the twenty-two districts or collectorates in that Presidency was less than a tenth of their normal fall.

A diffused storm in the first week of December gave light to moderate rain, chiefly in the coast districts south of Madras. The monsoon current withdrew from the Bay at the end of the first week of the month and hence about a week to a fortnight earlier than usual. The rainfall of the month was largely below the normal in all the Madras districts and the drought in that Presidency was as marked as in the preceding month.

The more important features of the meteorology of the year in India were the following:—

(1) The failure of the cold-weather rains over the plain and mountain districts of Northern India.

(2) The prevalence of finer and drier weather than usual over the whole of North-Western and Central India during the hot weather and the occurrence of exceptionally heavy rain, due to series of severe thunderstorms, in Bengal and Assam during April and May.

(3) The prevalence of strong and steady humid currents during the south-west monsoon.

(4) The feebleness of the retreating monsoon current in the Bay and the consequent failure of the rains and prevalence of severe drought over the Peninsula in November and December.

1893. *The cold-weather period.*—The rainfall of this period was above the normal over nearly the whole of India and was largely in excess in Northern and Central India, as is usual after abundant south-west monsoon rains. Eight cold weather storms or depressions advanced eastwards across Northern India during the period. Five were of considerable intensity, and gave heavy rain in North-Western India, and abundant snow in the Western Himalayas. Snow fell down to abnormally low elevations in the North-West Frontier Province. Thus it fell down to a height of 1,800 feet in the hill districts to the west of Dera Ismail Khan and to 2,000 feet in the Kurram Valley. The

lowest reported elevations at which snow fell in the Western Himalayas during this period were 1,800 feet in the Hazara Valley and 3,000 feet in Kulu. The snowfall of the month of January was exceptionally heavy over the greater part of the Afghan and Punjab mountain areas, and of February was normal or slightly above the average.

The rainfall of the cold-weather season over the whole of Northern India was very largely above the normal, the excess being greatest in North-Eastern India, the Punjab and the Central Provinces. The rainfall was greatest in actual amount in Bengal and the Punjab, *i.e.*, at the extremities of the Indo-Gangetic Plain.

The rainfall in Burma and the Peninsula generally is always small in amount in the months of January and February; but it was even less than usual in the cold-weather period of 1893—an example of the contrast of conditions between Extra-Tropical and Tropical India, which frequently obtains, more especially in the cold-weather.

The average rainfall of the Indian area including Burma during the cold-weather period was 2·39 inches (1·46 inches more than the normal).

The hot-weather period.—The cold-weather conditions were continued much later than usual and throughout nearly the whole of March in Northern and Central India. Several storms of the cold-weather type crossed Northern India, during the month, which was hence unusually cool. The most noteworthy feature of the month was the occurrence of frequent heavy rain over a large part of the Central Provinces and Central India. The abnormal precipitation during the storm periods inflicted great injury upon the cold-weather crops, more especially the wheat crop, in those areas.

Unusually cool weather continued throughout April in Northern India. Thunderstorms and duststorms were less numerous and vigorous than usual and the precipitation of the period in North-Eastern India due to these storms was much below the normal.

The most important rainfall of the months of April and May was determined by two cyclonic storms. The first of these formed in the Bay in the last week of April and advanced to Burma, to which it gave a brief but heavy general burst of rain. The second storm was generated in the north of the Bay in the fourth week of May and advanced by a curved path through Orissa, South-West and Central Bengal to Cachar. It gave heavy rain to Orissa, South Bengal and Cachar.

A temporary advance of humid winds occurred also in the west coast districts of Bombay during the fourth week of May, and gave those districts heavy rain earlier than usual, an indication of the early advance and unusual strength of the approaching monsoon currents.

The precipitation of the period was in excess in all districts except Assam, where it was practically normal.

The average rainfall of the period for the Indian land area was 7·32 inches, and was 28 per cent. above the normal of the period.

The south-west monsoon period.—The permanent advance of the south-west monsoon current in the Arabian Sea occurred in the first week of June and was not accompanied with the formation of a cyclonic storm. This current advanced with greater rapidity than usual from the Bombay coast across Central India and Rajputana, and the rains hence began from a week to three weeks earlier than usual in North-Western India.

The permanent advance in the Bay occurred during the second week of June. As usual, a cyclonic storm formed in front of the humid current. It crossed the North Madras

coast and marched along a curved track to Baghelkhand and gave a general and heavy burst of rainfall to the whole of the Gangetic Plain.

Both currents hence extended more rapidly than usual from the coast districts to the interior of Upper India. They were also abnormally strong during the remainder of June, during which month the whole of India, with the exception of Burma, Assam and North Bengal, received abundant rain.

The Bengal current was stronger than usual in July, but the Bombay current decreased in vigour to some extent and was slightly below its normal strength. Northern India obtained abundant rain, partly at the expense of Burma and Assam. The north of the Peninsula, Kathiawar, Gujarat and East Rajputana received less rain than usual, whilst the southern half of the Peninsula obtained larger amounts. This diversion of the Bombay current southwards was due to its want of strength.

Both currents were somewhat below their normal strength and volume in August, and the rainfall was generally below the normal. The deficiency was marked in the districts most remote from the coasts, *i.e.*, in North-Western and Central India. The rainfall of the month was, on the other hand, in slight excess in Burma and Assam, in which areas as well as in the Central Provinces, Berar and the Deccan it was below the normal in June and July.

The Bombay current was slightly weaker than usual in September, whilst the Bay current was abnormally steady and vigorous. Three cyclonic storms of moderate intensity formed in the north of the Bay during the month, and marched landwards along tracks defined by the position of the trough of low pressure in Northern India at the time of their advance. The first two advanced by curved tracks through Central India and the Central Provinces to the South-East Punjab or the United Provinces, and the third along a north-north-westerly and northerly track into Bihar. The whole of Northern and Central India received abundant rain in September and the Peninsula normal rain.

The rainfall of the monsoon period was above the normal in all districts with the exception of Berar and Sind, and was unusually large in amount in the Punjab, United Provinces, Bihar and Rajputana.

The retreating south-west monsoon period.—The monsoon currents withdrew from North-Western India in the last week of September, somewhat later than the normal date. The Bay current was for some time determined more strongly than usual to Burma and North-Eastern India and gave heavy rain in that area during the first fortnight of October. It was then diverted to the Peninsula about the middle of October and gave unusually heavy and frequent rain to that area until the end of November. The rainfall of the period was hence abundant over the Peninsula and was excessive in the month of November over the north of the Peninsula, including Berar, the Central Provinces and Central India. During this period pressure had increased more rapidly and largely than usual in Assam and Upper Burma, and was in considerable to large local excess during the greater part of November and December. Hence abnormally strong and dry northerly winds prevailed in November in Bengal, Burma and the north of the Bay and extended over the east and south of the Bay in December and the south-west monsoon current withdrew from the Bay in the beginning of that month. The rainfall of the Madras Presidency in December was consequently small in amount and confined to the South Coromandel coast districts and was chiefly due to intensified north-east monsoon winds and not to retreating south-west monsoon winds.

The whole of the Peninsula received abundant rain during the period. The rainfall was large in amount and unseasonable in character in the Central Provinces and Berar. It was also exceptionally heavy in the central and south coast districts of the Madras Presidency, more especially in the Godavari, Kistna, Nellore, Tanjore and Trichinopoly districts.

The more important features of the meteorology of the year were the following:—

(1) The cold-weather period was very disturbed and the rainfall of the period generally above the normal, the excess being very large in Northern and Central India. Snow fell to unusually low elevations in the hill districts of Northern India and the air was hence much cooler than usual in that area.

(2) Cold-weather conditions continued until nearly the end of March and series of disturbances of the cold-weather type affected Northern and Central India. Abnormally heavy rain occurred in the Central Provinces and Central India and inflicted much injury on the cold-weather crops. Weather was finer and drier than usual in the Himalayan region in April and May and more unsettled than usual generally in North-Eastern India and Burma, more especially in the coast districts, which received heavy rain from an early advance of humid winds during the last week of May. The precipitation of the whole period was in excess in all districts except Assam.

(3) The monsoon currents set in about the usual date on the Bengal coast and slightly later than usual on the Bombay coast. They, however, advanced more rapidly than usual into the interior and abundant rain was received in June over the whole of the country. The currents were unusually steady and strong in July and September and gave abundant rain throughout the country. They were, on the other hand, below their normal strength in August, in which month the rainfall was generally in defect. The rainfall of the whole period was above the normal in all districts except Sind and Berar and was unusually heavy in Northern India.

(4) Unusually heavy rain occurred in the Peninsula from the middle of October to the end of November when the south-west humid winds withdrew finally from the Bay. The rainfall was excessive in the Central Provinces and Hyderabad.

1894. *The cold-weather period.*—A considerable number of cold-weather storms affected the weather in Northern India during this period. Four advanced eastwards in January and three in February. They were all diffused disturbances of slight vitality which either did not extend into North-Eastern India or filled up as they advanced eastwards, and were very feeble when they passed into that area. The precipitation due to these storms was hence almost restricted to North-Western India. The snowfall in the Himalayan area due to these storms, although heavy, was confined to considerably greater elevations than usual, and was most largely in excess in the interior ranges and in Ladakh and the Karakorum mountain area. In consequence of the abnormal character and distribution of the snowfall, the cold waves which followed the storms in their passage across Northern India were much feebler than usual, and the disturbed weather of the period exercised comparatively little influence on the temperature conditions.

The rainfall of the period was very irregularly distributed in Northern India. It was in general and considerable excess in North-Western India but was scanty and in large defect relatively to the normal in North-Eastern India.

The hot-weather period.—Weather was slightly more disturbed than usual in Northern India in the month of March. It was drier than usual in North-Western and Central India in April. May was exceedingly hot and dry over the whole of India, with the exception of Burma, Assam and East Bengal.

Burma obtained heavy rain during the fourth week of April from a cyclonic storm which initiated feeble monsoon conditions in that area, and frequent moderate rain fell during the month of May before the burst of the monsoon proper. The rainfall of the period was hence in large excess in that area. Also as almost invariably occurs when the hot-weather conditions in Northern and Central India are more pronounced than usual, Assam, North and East Bengal received frequent thundershowers and the rainfall of the period was in slight to considerable excess. Abnormally dry weather obtained during the whole period (but more especially in May) in Orissa, West and Central Bengal, Bihar and Chota Nagpur. The rainfall was practically *nil* in those areas and was small in amount in the United Provinces, the Punjab, Sind, Rajputana, Central India, Berar, and the Central Provinces and was more or less in defect in all those provinces. The percentage deficiency was small in the Punjab, and was large, relatively to the normal, in the remaining districts.

The south-west monsoon period.—The rainfall of this period was larger in amount than usual and was continuous throughout the season and very favourably distributed, as no long break in the rains occurred in any part of India.

Southern India received more frequent rainfall from thunderstorms in May than usual. The burst of heavy continuous rain, which initiates the south-west monsoon proper, occurred somewhat later than usual in the first week of June. The monsoon current was established at Bombay on the 7th June and extended rapidly into the interior, reaching the Punjab on the 17th. The advance of the great monsoon humid wave over the Arabian Sea was effected more quietly than usual, as no cyclonic storm formed in that area during its progress towards India. The current was unusually steady and gave frequent moderate to heavy rain over the whole field of its extension during the next three months.

The Bay current was established somewhat earlier than usual. The advance in the north of the Bay gave rise in the second week of June to a cyclonic storm, which marched by a curved path to the Punjab. A second and more severe storm was generated in the third week of the month and advanced westwards to Rajputana, giving a heavy burst of rain to the areas it traversed. The Bay current, although strong, was very unsteady in July, giving rise to a series of three cyclonic storms of moderate to considerable intensity. It was, on the other hand, unusually steady in August and September. The rainfall was below the normal in June and July in two areas only, *viz.*, the Deccan and Assam, North and East Bengal. These areas, however, obtained frequent and moderate to heavy rain in the latter half of August and in September. The south-west monsoon rainfall in India was more abundant than usual over the whole Indian area and was excessive over the greater part of the United Provinces.

The retreating south-west monsoon period.—The rains ceased in Upper India (*i.e.*, Sind, the Punjab and the greater part of Rajputana) in the fourth week of September. The Bay current was directed chiefly to North-Eastern India and Burma during the first fortnight of October. A storm advanced in the first week of the month from the Bay to the eastern districts of the United Provinces, to which it gave a heavy burst of rain. The

so-called north-east monsoon rains in the Madras Presidency were initiated by a storm which formed in the centre of the Bay, and advanced to the North Coromandel coast during the third week of the month. A second cyclonic storm (part of the same general disturbance) formed in the Arabian Sea and advanced to the Kathiawar coast and Gujarat. The double disturbance gave heavy and untimely rainfall to Central India, Kathiawar, Gujarat, the Central Provinces and the Gangetic Plain. The third and last cyclonic disturbance of the period formed in the Bay in the last week of October and advanced across the Madras Coast on the 2nd of November into the Deccan on the 3rd, partially filling up. The residual depression, like so many of the storms of the year, thence marched to the eastern districts of the United Provinces to which it gave a very heavy and most untimely burst of rain. The persistent determination of the storms of the period to the central districts of the Gangetic Plain was one of the most noteworthy features of the meteorology of the year. After the disappearance of this disturbance rain continued to fall in moderate amounts in Madras until the third week of November, and then decreased rapidly, due to the final withdrawal of the south-west monsoon current from the Bay at the end of the month. Light showers were occasionally received in the South Coromandel coast districts from north-east winds in December, but the rainfall was scanty.

Weather in December was unusually disturbed in Upper India. A series of feeble depressions of the cold-weather type affected that area and gave moderate rain, much earlier in the season than usual.

The chief features of the meteorology of the year were as follows:—

(1) The cold-weather rains were more abundant and favourable than usual and were prolonged into March.

(2) The hot-weather was, on the whole, more intense than usual over the greater part of India. May was abnormally hot and dry and, as usual under these conditions, Assam and North and East Bengal had more frequent and severe thunderstorms than usual and hence increased rainfall.

(3) The monsoon currents, as judged by the rainfall, were unusually steady and strong and gave abundant rain to the whole of India and more especially to the interior districts of Northern India.

(4) The distribution of rainfall due to the retreating south-west monsoon in the Bay was very remarkable, due to the determination of the storms of the period much further landwards and northwards than usual to a persistent sink in the central districts of the Gangetic Plain. The rainfall during October and November was hence excessive and unseasonable in the United Provinces, Bihar, Baghelkhand and the northern districts of the Central Provinces and also in Gujarat, Kathiawar and Cutch. The rainfall was on the whole abundant and favourably distributed over the south and centre of the Peninsula.

(5) The cold-weather rains commenced unusually early in December.

1895. *The cold-weather period.*—Weather was more disturbed than usual in North-Western India during this period. A succession of four storms advanced eastwards in January and the first week of February. The precipitation due to these storms occurred chiefly in North-Western India, while the snowfall in the Western Himalayas was confined to considerably higher elevations than usual and was in excess only in the interior ranges.

The rainfall of this period was very irregularly distributed in Northern India. It was

in general excess, slight to moderate in amount, in North-Western India, but was very scanty and in large defect, relatively to the normal, in North-Eastern India.

The cold-weather rains of Northern India terminated in the second week of February, and hot-weather conditions were initiated in the Deccan and North-Eastern India at least a fortnight before the normal date.

The rainfall of the period in Berar, the Central Provinces and the Deccan was generally in slight excess due to the occurrence of numerous series of thunderstorms during the hot period in the second fortnight of February.

The hot-weather period.—Weather was less disturbed than usual in Upper India in the month of March, and was very dry over the remainder of India. Numerous series of thunderstorms occurred in the Peninsula, East Bengal and Cachar in April, which gave somewhat heavier rain than usual. Very dry hot weather prevailed over North-Western and Central India. A cyclonic storm which formed in the Bay and advanced to the Arakan coast gave moderately heavy general rain to Arakan and Burma in the last week of the month of April. May was hotter and drier than usual over the whole of India with the exception of Burma, Assam and East Bengal.

The rainfall of the period was in moderate excess in Burma, Assam and North and East Bengal, but was small in amount and below the small normal of the period over the whole of North-Western and Central India and the north and centre of the Peninsula.

The south-west monsoon period.—The rainfall of this period was considerably less in amount than usual and was very unfavourably distributed in some districts. The monsoon currents were of normal strength in June. They were feeble in July, and a more or less complete break obtained during the first three weeks of the month over the greater part of Northern and Central India. They were moderately strong in August and gave normal and, on the whole, favourable rain during that month. The monsoon currents withdrew from Upper India in the first week of September, upwards of a fortnight before the normal date of their retreat.

The total rainfall of the period was more or less in defect over the whole of Northern and Central India and the north of the Peninsula. The deficiency was most marked in Bengal, Rajputana, the Punjab, Central India and Berar.

The retreating south-west monsoon period.—The Bay monsoon current withdrew from North-Eastern India and Burma in the first week of October and was determined earlier than usual to the Madras coast districts. The rainfall due to that current was abundant in the Peninsula in October, very scanty in November, and in moderate excess in Southern India in December, due almost entirely to a late and heavy general burst of rain accompanying an imperfectly developed cyclonic storm in the extreme south of the Bay during the last week of the month. The weather was slightly disturbed with feeble depressions of the cold-weather type in Upper India during the months of October and November. The rainfall of the period was in defect in all areas except South India and there it was normal in amount.

The chief features of the meteorology of the year in India were as follows :—

(1) Weather was slightly more disturbed than usual during the cold season in North-Western India to which the storms of the period gave moderate and favourable rain. The snowfall of the Western Himalayas was heavier than usual only on the higher ranges.

(2) The hot weather was more intense than usual and was abnormally dry over the whole of North-Western and Central India. Burma, Assam and North and East Bengal, on the other hand, received rainfall in moderate excess, due to the frequent occurrence of thunderstorms.

(3) The monsoon rains were less favourable than usual. They commenced about the normal date but the currents were not strong. The chief features were the occurrence of a longish break over the whole of Northern and Central India from the 2nd to the 20th July and the early termination of the rains in the same areas, at least a fortnight before the normal date

(4) The Bay monsoon current withdrew slightly earlier than usual from Burma and North Eastern India; it was determined to Madras from the middle of October and gave moderate to abundant rain to that area in October and December.

1896. *The cold-weather period.*—The rainfall of this period was very scanty and in large defect, relatively to the normal, over the whole of India, except Burma, Assam and Central Madras. A considerable number of feeble cold-weather depressions affected the weather in Northern India during the first six weeks of this period, giving much cloud but little rain. Three appeared in Upper India in January and two in February They were all shallow diffused disturbances which either did not pass into North-Eastern India or filled up as they advanced eastwards, and were very feeble when they passed into that area. The precipitation due to these storms was practically restricted to North-Western India, and occurred as snow above higher elevations than usual in the Himalayan area. The winter snowfall in the mountain area bordering Upper India was moderate in amount and in defect except perhaps on the highest ranges.

The rainfall of the period was practically normal in amount in the Punjab and more or less in defect in Rajputana, Central India, the Central Provinces, the United Provinces, Bihar and Bengal.

The hot-weather period.—Weather was slightly less disturbed than usual in Upper India in the month of March, and was very dry over the remainder of India. Numerous series of thunderstorms occurred in April in the Assam Valley and Cachar which hence received heavier rain than usual. Over the remainder of India the rainfall was scanty and in general defect. May was hotter and drier than usual over the whole of India with the exception of North and East Bengal, the Assam Valley and North Bihar, where series of thunderstorms gave frequent showers and abundant rainfall. On the other hand, weather was less showery than usual in Cachar. Lower Burma obtained moderate rain during the third week of May from a feeble cycloric storm.

The weather of the whole period was unusually dry in Burma, Orissa, West and Central Bengal, Bihar and Chota Nagpur, and the rainfall in moderate to considerable defect. It was also more or less below the normal in the United Provinces, the Punjab, Sind, Rajputana, Central India, the Central Provinces and Berar. The deficiency was small in actual amount in Rajputana, the United Provinces and Central India, but was large, relatively to the normal, in the remaining districts. It exceeded one inch in the Punjab and Central Provinces.

The south-west monsoon period.—The meteorological features of this period were very abnormal. Hot-weather conditions in their most intense form continued in North-Western

and Central India about a fortnight later than usual, due to the delay in the establishment of the monsoon in the Arabian Sea.

The advance of the monsoon current in the Arabian Sea was accompanied by very squally weather which however failed to develop into a cyclonic storm. The monsoon current was established on the Bombay coast on the 14th June. It was fairly steady and of moderate strength throughout July and August, but fell off rapidly in the last week of August and was unusually feeble in September.

The monsoon rains in Bengal were initiated in the third week of June by a cyclonic storm of moderate intensity. It passed west-north-westwards from the head of the Bay to West Rajputana and Upper Sind. A second storm originated in the north-west angle of the Bay while the first storm was filling up. It marched across the Bengal coast by a curved path into the western districts of the United Provinces and gave a general and heavy burst of rain to the Gangetic Plain.

The Bay current held without any general break throughout the remainder of June, and also during July and the first three weeks of August, but was even less steady than usual. A large number of cyclonic storms formed in the Bay during the period. These depressions advanced in the same general direction across a broad belt of country at the head of the Peninsula, stretching from Orissa to Gujarat and Kathiawar. The indraught to the storms affected the distribution of the rainfall in two respects. It diminished the rainfall in Bengal and the Gangetic Plain, and distributed it more largely and copiously in cyclonic downpours over the areas traversed by the storms, including Orissa, the southern districts of Chota Nagpur, the Central Provinces, Berar, the south-western districts of Central India, Rajputana, Gujarat and Kathiawar.

The monsoon currents withdrew from Upper India in the fourth week of August, about a month, and from North-Eastern and Central India and the Central Provinces five to six weeks, earlier than usual. This early retreat was accompanied by a considerable excess of pressure in Central India and the Deccan during the month of September.

The rainfall of the monsoon period in 1896 was largely below the normal over the whole of Northern and Central India, the deficiency being greatest in absolute amount in Bengal and relatively to the normal in the Punjab, Rajputana, Central India and the United Provinces.

The retreating south-west monsoon period.—The monsoon currents withdrew from the whole of Northern and Central India much earlier than usual. Hence little or no rain was received over the whole of that area in October and the rainfall of the month (of great importance for the rice crops in these districts)was in more or less serious defect. Frequent light to moderate showers were received in Burma and Southern India.

Burma and Southern India also obtained frequent rain in the month of November, but little or no rain fell in Assam, Bengal and Orissa. A cyclonic storm of moderate intensity which formed in the Arabian Sea on the 15th and 16th, passed by a curved path across the Kathiawar coast into the interior and gave a general moderate burst of rain to the United Provinces, Central India, Rajputana, Kathiawar and Gujarat—areas which as a rule obtain no rain in November. The rainfall of the month was hence in marked excess in these areas.

The rains ceased in Burma at the end of November. Southern India obtained frequent heavy showers in December until the 24th, when fine dry weather set in. A depression of an unusual cold-weather type formed in Kathiawar and Gujarat on the 26th, passed north-

eastwards through Rajputana on the 27th and 28th and gave disturbed showery weather from the 27th to the 31st in the Central Provinces, Central India, Rajputana, the Punjab and the United Provinces.

The rainfall of the period was in defect in all areas except South India, East Rajputana, Central India, and Gujarat where it was in slight excess.

The chief features of the meteorology of the year 1896 were as follows:—

(1) The weather was less disturbed and drier than usual in the cold season. The rainfall in Upper India was hence below the normal and the snowfall in the Western Himalayas much less than usual except perhaps on the higher ranges. The period was unusually dry in North-Eastern India where practically no rain fell.

(2) The hot-weather was characterized by higher temperature and greater dryness of the air than usual. May was remarkably hot and dry, and hot-weather conditions were continued until nearly the end of June in Upper India. Assam and North Bengal obtained somewhat larger amounts of rain than usual from thunderstorms, but elsewhere the rainfall was scanty and the whole season remarkably dry.

(3) The monsoon rains commenced considerably later than usual and very feebly on the West Coast, and about the normal date in Bengal. Both currents were not so strong as usual. The Bombay current was fairly steady in July and August. The Bengal current was very unsteady and a series of cyclonic storms formed in the north of the Bay and passed across India by much more southerly tracks than usual, thus diminishing the rainfall in North-East India and giving heavy rain to districts at the head of the Peninsula. The season was remarkable for the abnormally early withdrawal of the monsoon currents and termination of the rains over the whole of Northern and Central India. The rainfall was throughout very deficient in the United Provinces over a large portion of which area the crops failed almost entirely, and the early termination of the rains prevented the crops from coming to maturity in the Central Provinces, Berar and Central India, which areas had received favourable rain during the months of July and August.

(4) The greater part of Madras received moderate rain from the retreating south-west monsoon. The chief features of that period were two cyclonic storms which gave late and abnormal rain to North Bombay and the Central Provinces, Berar and Central India; these were too late in the season to be of agricultural value for sowing the cold-weather crops in areas where the land had been parched by the heat and dryness of September and October.

1897. *The cold-weather period.*—Weather was less disturbed than usual throughout the season. One cold-weather storm of moderate intensity crossed Northern India on the 14th and 15th of January and filled up in Bengal on the 16th. A secondary depression gave stormy weather in the Punjab, more especially in the hill districts, on the 14th and 15th. Heavy snow fell in the Punjab and Kashmir Himalayas, and moderate snow in the Afghan and Baluch mountain districts. The cool wave following the storm was of marked intensity.

Two cold-weather storms affected the weather in Northern India in February. The

first originated in Upper Sind and the South-West Punjab on the 10th and 11th and drifted eastwards to the foot of the Simla hills. It gave general and heavy snow in the Kashmir and Punjab Himalayas on the 12th and 13th, and moderately heavy and general rain in the north-west and submontane districts of the Punjab. The second storm was initiated in Persia. It advanced across Baluchistan and Northern India between the 22nd and 26th and gave rise to a deep secondary depression in the Punjab. The storm gave moderate snow in the Western Himalayas, and numerous thundershowers in the Punjab.

The snowfall of the period was practically normal in Baluchistan and Afghanistan, and heavier than usual in the Kashmir and Punjab Himalayas, and was especially heavy in North Kashmir. The precipitation of the period was below the normal generally in Northern and Central India, the deficiency increasing, both absolutely and relatively to the normal, from the South-East Punjab to Bengal.

The hot-weather period.—Weather was more disturbed than usual in Northern India in March, due to the advance of several depressions of the cold-weather type across Northern India. Kashmir and the Punjab hill districts received frequent and heavy snow during the month, and the Punjab, more especially the northern districts, moderate rain. One of the storms gave rise to an unusually general and heavy burst of rain in North-Eastern India.

April was cooler and more disturbed than usual, more especially in Upper India. The Punjab and Kashmir Himalayas, Baluchistan and the North Punjab hence received somewhat larger rainfall than usual. Weather was, on the other hand, finer and drier in North-Eastern India, and the rainfall was in largish defect in the areas which usually receive moderate to heavy rain from thunderstorms, *viz.*, Assam, North and East Bengal.

May was *hotter and drier than usual over nearly the whole of India.* Burma obtained moderate rain in May and North Bengal and Assam received more frequent thundershowers than usual during the month.

The south-west monsoon period.—The rainfall of the period was on the whole slightly larger in amount than usual, and was very favourably distributed over the greater part of India. The monsoon currents were below their normal strength in June and July, and were practically of normal strength in August and September; the rainfall of these two months was unusually well distributed and favourable for the crops. The monsoon currents withdrew from Upper India in the fourth week of September which is nearly a fortnight after their normal date.

The burst of heavy continuous rain which initiates the south-west monsoon proper on the West coast of India occurred somewhat later than usual in the second week of June. The humid current advanced rapidly into the interior and gave a general and heavy burst of rain in Berar, the Central Provinces, Central India, Rajputana, and the East Punjab from the 13th to the 24th of June.

The Bay current was established in Bengal about the normal date and, as usual, accompanied the advance of a cyclonic storm, which formed in the north-west of the Bay, crossed the Orissa Coast on the 17th and marched to Bundelkhand on the 19th. The monsoon currents withdrew gradually from Northern and Central India in the last week of June and an almost complete break in the rains obtained over that area until the 7th of July when heavy monsoon rain recommenced in the coast districts and rapidly extended into the interior. A second and short break in the rains, somewhat less pronounced than the previous, held from the 25th to the 29th of July.

The rains continued with remarkable steadiness during the months of August and September, and gave frequent and moderate rain to nearly the whole of India.

The rainfall of the period was practically normal in amount over the Indian area. It was below the normal during the first two months and above it in August and September, (the rainfall during which period is of greater importance for the growth and ripening of the crops than that of the earlier monsoon months). The season was hence remarkably favourable from the agricultural standpoint, and brought the famine of 1896-97 to a complete close.

The retreating south-west monsoon period.—The south-west monsoon currents withdrew from Upper India and the western half of the Gangetic Plain in the fourth week of September, and from Bihar, Bengal and the Deccan in the third or fourth week of October. The Bay current was weaker than usual in October and November and was chiefly determined by the pressure conditions to the east of the Bay, Tenasserim and Lower Burma. A storm of moderate intensity formed off the Circars coast on the 1st of October and marching by a curved path passed into Bihar on the 5th. It occasioned heavy rain over North Madras and North Eastern India. A small cyclone of great intensity passed northwards from the neighbourhood of the Andamans to the Chittagong Coast and gave very heavy rain in the Chittagong district and South Lushai Hills on the 24th October. A diffused cyclonic disturbance advanced westwards across the centre of the Bay to the Madras coast in the third and fourth weeks of November and was followed by light to moderate general rain over the centre and south of the Peninsula from the 25th to the end of the month. Finally, a cyclonic storm of moderate intensity formed in the centre of the Bay on the 24th December and advanced northwards to Lat. 16°N and Long. 86°E, where it filled up without reaching land. It gave cloudy weather, but little rain, in the coast districts of the Bay.

The pressure conditions in Burma, North-Eastern India, the Peninsula and the Bay were throughout unfavourable to the determination of the retreating south-west monsoon current in the Bay towards the Madras coast, and the chief feature of the season was the very scanty and deficient rainfall over nearly the whole of the Madras Presidency and Mysore. North-east winds prevailed with unusual steadiness in November and December in the north and west of the Bay. They were much stronger than usual in the south-west of the Bay, and gave occasional light to moderate showers in a narrow belt of the South Madras or Coromandel coast districts.

A feeble cold-weather storm affected Upper India in the second week of December. It gave light to moderate rain in Baluchistan and the Punjab, and moderate to heavy snow in the Kashmir and Punjab Himalayas.

The rains ceased in Burma during the fourth week of November. Southern India obtained frequent heavy local thundershowers from the 14th to the 20th December when fine dry weather set in.

The rainfall of the season was favourable in Burma and South Madras, although it was below the normal to a moderate extent. It was very scanty in other districts, more especially in the Deccan area which usually obtains moderate rain in this period.

The following is a brief statement of the meteorological features of the year 1897:—

(1) Weather was finer and on the whole less disturbed than usual in the plains of Northern India and the rainfall of the period was scanty and largely below the normal.

(2) As occasionally happens after a dry cold season, weather was more disturbed and more showery and cooler than usual in Northern India in March and April. May was abnormally dry and hot and the rainfall of the period was more or less in defect over the greater part of Northern India.

(3) The monsoon currents were later than usual in being established and were also below their normal strength in June and July. Both currents were strong and steady in August and September and the rainfall of the period was satisfactory and well distributed.

(4) The Bay current was feebler than usual in October and November, and was at first more largely determined than usual to Burma and afterwards to Southern India. These areas hence received on the whole favourable rain. The precipitation was, on the other hand, very deficient in the interior of the Peninsula, more especially the Deccan districts.

(5) The famine of 1896-7 was terminated by the favourable rainfall of the year 1897 and the crops were on the whole most abundant in the districts which had suffered most severely from drought in the previous year, more especially the United Provinces.

1898. *The cold-weather period.*—The rainfall of the period was very abnormal in its occurrence and distribution. It was scanty and in large defect, relatively to the normal, over nearly the whole of India in January. Two cold-weather storms of moderate intensity affected the weather in Northern India in that month; the precipitation due to these storms occurred chiefly in the Punjab and Kashmir.

The chief feature of the month of February was the occurrence of general rain over practically the whole of India from the 9th to the 18th. This was due to a succession of depressions which originated in India. The most important formed much further south than usual, in Kathiawar, Gujarat and South-West Rajputana on the 8th and 9th. The general disturbance due to the series of depressions extended over the whole of India and the burst of rain was more general and widely spread than any which has occurred in February during the previous 20 years.

The snowfall of the period was probably considerably below the normal over the whole of the Western Himalayan area. The rainfall of the period was normal in Bihar and Assam and in slight to considerable defect in Bengal, Orissa and Chota Nagpur. It was, on the other hand, in considerable excess in the United Provinces, Central India, Rajputana and the Punjab (due to the heavy rainfall of the month of February) and in very large excess over the whole of the Peninsula, excepting Berar and Mysore, where it was in slight defect.

The hot-weather period.— March was much drier than usual in the plains of Northern India. A series of five depressions of the cold-weather type crossed Northern India, but gave no rain except in Baluchistan, the North Punjab and Kashmir. Moderate to heavy snow was received during these disturbances in Chitral, the Afghan mountains and the higher Kashmir ranges. April was abnormally dry and hot and its rainfall very scanty in Extra-Tropical India. Bengal and Assam had series of thunderstorms on the 12th and 13th and the 17th, 18th and 19th, and Southern India and the West coast from the 25th to the 28th. The rainfall of the month was in large and serious defect in the Assam Valley, Cachar and parts of North Bengal, thus affecting the early tea crop in these areas very prejudicially.

May was also drier than usual and the rainfall more or less below the normal over nearly the whole of India but more especially in North-Eastern India, where it was largely in defect. Burma, on the other hand, had more frequent and abundant rain than usual. This pre-monsoon burst of rain in Burma was initiated by a cyclonic storm which advanced from the Bay across the Arakan coast in the second week of the month.

The rainfall of the hot weather was thus in large and serious defect in North-Eastern India, more especially in the hill districts of Assam and Bengal.

The south-west monsoon period.—The rainfall of the period was slightly above the normal on the mean of the whole of India, and was also favourably distributed in time except in the Punjab, Rajputana, Central India and the Central Provinces, where the rains terminated earlier than usual. The monsoon currents were slightly below their mean strength in June, but were strong in July, when favourable pressure and other conditions determined them to their extreme limits in Upper India.

The burst of heavy rain which initiates the monsoon in the West coast districts commenced slightly later than usual, *viz.*, on the 9th and 10th June.

The Bay current was established over the north of the Bay and in Bengal about the normal date. A storm formed in the north-west of the Bay in front of the advancing current, and the first burst of heavy general rain in North-Eastern India accompanied the advance of this storm.

The monsoon current on the West coast fell off rapidly on the 17th and 18th of June and a short break in the rains commenced in Upper India on the 19th. It extended to the Gangetic Plain, Central India and the Deccan on the 21st and to Bengal on the 25th. Rain recommenced on the 29th and was fairly general on the 30th.

The currents were fairly steady in July and the greater part of India received abundant and favourable rain. The Bombay current was weak in August, and those areas which are chiefly dependent upon it, including the Punjab, the Deccan, the West coast districts, Berar and Rajputana, received less rain than usual, whilst the districts in the field of the Bay current obtained heavier and more frequent rain than usual. The Bombay current was very feeble in September and the rainfall of the month was more or less in defect in North-Western and Central India and the North Deccan, *i.e.*, in the Punjab, Rajputana Central India, North Bombay, Berar and the Central Provinces. It gave on the other hand unusual and favourable rain to the Central and South Deccan and Southern India. The Bay current in September gave satisfactory rain to North-Eastern India. The rainfall of the month was in excess and on the whole favourably distributed over the remainder of India. The excess was most pronounced in the Deccan and Southern India, and the deficiency in the Punjab and Rajputana.

On the mean of the whole monsoon period the rain was in moderate excess in North-Eastern India, normal in the Peninsula and more or less in defect in North-Western India.

The retreating south-west monsoon period.—The monsoon currents withdrew from Upper India in the third week of September and from Bengal, Burma and the Deccan in the third or fourth week of October. This change was accompanied by a larger increase of pressure than usual over the whole of Northern and Central India and Burma. Hence the humid south-west current in the Bay was chiefly determined during the remainder of the period to the south-west of the Bay, the Coromandel coast districts and South India.

The chief feature of the whole period was the absence of severe cyclonic storms in the Bay. A small cyclone of moderate intensity passed west-north-westwards in the second week of October from the centre of the Bay to the Circars coast, where it recurved and passed along the eastern flank of the East Ghats through Ganjam and Orissa into South-West and Central Bengal, and filled up in North Bengal on the 16th October. A cyclonic storm of moderate intensity advanced from the centre of the Bay to the Madras coast in the first week of November, and was followed by light to moderate general rain over the centre and south of the Peninsula from the 5th to the 16th of the month. Finally, a diffused cyclonic disturbance formed in the south of the Bay on the 27th December, and advanced westwards across North Ceylon and the southern districts of Madras. It gave a heavy burst of rain in South Madras and Ceylon. Fine and unusually dry weather held steadily in North-Western and Central India during the season until the last week of December, when a cold-weather storm gave moderate to heavy snow in the hill districts in Upper India.

The rainfall during the retreating south-west monsoon period was abundant and favourable over the greater part of the Madras Presidency and the excess was large in amount in the coast districts from Nellore southwards. It was, on the other hand, very scanty over the whole of North-Eastern and Central India and the North Deccan which usually receive moderate rain in the first-half of the period. Over the greater part of that area the total rainfall of the period was less than 20 per cent. of the normal.

The following gives a brief statement of the most prominent and important features of the meteorology of the year 1898 in India:—

(1) The weather in India was more disturbed than usual in the cold season. The disturbances were of a very unusual type, and the accompanying rainfall very abnormal in distribution. The greater part of the Peninsula, North-Western and Central India received abnormally heavy rain and some districts of the Peninsula from five to ten times the normal fall of the period The rainfall in North-Eastern India was, on the other hand, considerably below the normal and the snowfall in the Western Himalayas very deficient.

(2) Weather was very disturbed in March in Upper India and the adjacent mountain districts. March and April were unusually cool months. May, on the other hand, was very hot and dry. The chief feature of the season was the scanty spring and hot-weather rainfall in Assam and Bengal due to the comparative absence of thunderstorms.

(3) The monsoon rains commenced slightly later than usual on the Bombay coast and on the normal date and in the usual manner in Bengal. The Bombay current was steady but somewhat weaker than usual, more especially in the latter half of the period, and hence the rainfall in the interior districts including the Punjab, Rajputana, Central India and Berar was more or less in defect and the rains terminated earlier than usual. The Bay current, on the other hand, gave favourable and satisfactory rain over nearly the whole of Northern India and Burma; it withdrew about the normal date from Bengal, but earlier than usual from Burma.

(4) The rainfall due to the retreating monsoon in the Bay occurred chiefly in the southern half of the Peninsula, where it was in slight to moderate excess.

It was, on the other hand, scanty and deficient in the North Deccan area and Central Madras.

1899. *The cold-weather period.*—January was unusually free from cold-weather storms in Northern India. The chief features of the weather of the month in India generally were abnormal dryness of the air, small amount of cloud and scanty rainfall. Temperature was on the mean of the month considerably lower than usual in Northern and Central India, the Central Provinces, Berar and the North Deccan, the deficiency being slightly more marked in the night than the day temperature. These abnormal features of the month were apparently due to a steady persistent large excess of pressure in the Persian area and a strong outflow of cold dry air from that area to the Indian region, and probably related to general conditions in South-East Europe and Central Asia.

There were in all six disturbances or cold-weather storms during the month of February, a larger number than usual. They were, however, very feeble and gave much less rain, both in amount and extent, than usually accompanies these storms.

The first disturbance gave rain only to Baluchistan and the Punjab, the second and third to Northern India generally, the fourth to Baluchistan, the Punjab and Assam, and the sixth to Bengal and Assam only. The rainfall of the month was smaller than usual in amount in the areas of rainfall.

The precipitation of the cold-weather period was above the normal in Bihar, Bengal, Assam and South Madras and in defect in all other districts. The deficiency was large in North-Western and Central India.

The hot-weather period.—Weather was less disturbed and much drier than usual in March over Northern India. Three disturbances of the cold-weather type formed in Persia during the month, but decreased in intensity and importance as they advanced eastwards and influenced weather very slightly in Upper India.

April was more disturbed than usual over the whole of India. A succession of hot-weather depressions formed in Sind and passed eastwards across Upper India. Each depression during its advance gave series of duststorms in the plains and lower hill ranges and snowstorms in the higher ranges of the Kashmir and Punjab Himalayas.

The most abnormal feature of the month was an unusually prolonged and excessive burst of rain (accompanying thunderstorms) between the 10th and 24th in the Peninsula and North-Eastern India. The rainfall of the month was hence in excess over the greater part of India and the excess was abnormally large in the southern half of the Peninsula.

May was less disturbed than usual and temperature was steadily in excess during the month in North-Western India. The advent of the monsoon was delayed in the southern half of the Peninsula and the rainfall of the month was hence considerably below the normal in that area. A small cyclonic storm advanced into Burma in the first week of the month and was followed by the prevalence of humid winds which gave excessive rain in that area. Bengal and Assam also received frequent rain from local thunderstorms.

The rainfall of the hot-weather period was more or less in defect over nearly the whole of North-Western and Central India, Chota Nagpur, North and Central Bengal and Cachar and in excess over the remainder of India and Burma. The excess was most marked in Lower Burma and the coast districts of Madras where it varied between 68 and 80 per cent. The deficiency was largest in percentage amounts in the Punjab, Rajputana and Central India, which obtained barely half their normal amount.

The south-west monsoon period.—The south-west monsoon current was established in the Arabian Sea slightly later than usual. It began to give heavy rain on the Konkan coast on the 10th and 11th June, and was of moderate strength until the 22nd, when it fell off considerably and withdrew from the central parts of the country. The north of the Peninsula, Central India and Rajputana received general light rain from the 12th to the 14th.

The Bay current was established at the head of the Bay on the 11th and 12th of June, and advanced rapidly up the Gangetic Plain as far as the central districts of the United Provinces on the 13th and 14th. A further advance into the western districts of the United Provinces, North-East Rajputana and the East Punjab occurred on the 21st. These districts received favourable rain during the remainder of the month.

The Arabian Sea current was abnormally feeble during the remainder of the season and gave no general heavy rain over the area usually dependent upon it. The northern districts including Sind, East and Central Rajputana, the western states of Central India, Cutch, Kathiawar and Gujarat received practically no rain in July, August and September. The Konkan coast districts had occasional light to moderate rain, and Berar, the Deccan and Central Provinces light showers. This current hence failed almost entirely as a rain-giving current over the greater part of its field in India during these three months.

The Bengal current was slightly stronger than usual in July and practically of normal strength in August and September. It was determined more largely than usual towards Burma and North-Eastern India, more especially to Bihar and the United Provinces in July, and to Bengal, Assam and Burma in August and September. These provinces all received favourable rain. The rains ceased considerably earlier than usual (in the latter part of August) in the East Punjab and the western districts of the United Provinces.

The rainfall of the period was normal in amount (and also very favourably distributed in every respect) in Burma. It was in slight to considerable excess in Assam, Bengal, and Bihar. It was, on the other hand, in very serious defect over nearly the whole of the Peninsula and North-Western India, the deficiency ranging between averages of 40 per cent. and 77 per cent. in the Punjab, Rajputana, Central India, Berar, the Central Provinces and Bombay. The drought was so severe that, except in irrigated districts of the areas affected, the crops failed entirely and it was necessary to give famine relief during the next twelve or eighteen months to a large part of the population of the South-East Punjab, Rajputana, Central India, Berar, the Central Provinces, Cutch, Kathiawar and Gujarat.

The retreating south-west monsoon period.—The south-west monsoon currents in the Bay withdrew earlier than usual from the Bay area. In the first week of October weather was showery in Burma and Southern India and fine and dry elsewhere. There were two periods of stormy weather in the Bay during October. The first disturbance developed into a cyclonic storm of moderate intensity and advanced northwards into Orissa and Bengal to which it gave a heavy downpour of rain from the 14th to the 16th. The Madras coast districts received frequent moderate rain from the 19th to the 31st. The second disturbance of the month in the Bay was diffused in character. It gave a moderate burst of rain to Bengal, Orissa and Assam from the 27th to the 29th.

A disturbance in the Bay in the second week of November gave moderate to heavy rain in Southern India from the 12th to 14th. With this exception the month was unusually dry in the Peninsula. Several shallow depressions advanced into Upper India from Baluchistan. They gave cloud and light rain or snow in the Upper India Hills.

A feeble disturbance gave rain to Ceylon and the coast districts of Southern India from the 10th to the 13th or 14th December. This was the last rainfall received from the retreating south-west monsoon in Southern India.

Several depressions advanced from Persia and Baluchistan into Upper India in December. They were all of little importance except the last of the series. This formed over South Persia and the Persian Gulf on the 27th, passed through Baluchistan on the 28th and across Upper India on the 29th and 30th. It gave some rain in the Punjab plains and a moderately heavy fall of snow in the Punjab and Kashmir Himalayas.

The chief feature of the period was the scanty rainfall over the greater part of the Peninsula. This was due in October to a determination of the storms of the period to Bengal, and in November to the early withdrawal of the monsoon currents to the extreme south and south-west of the Bay and Southern India. The rains of the retreating south-west monsoon hence failed almost completely over the greater part of the Peninsula including Berar, the Central Provinces, Hyderabad and the Bombay and Madras Deccan—thus intensifying the drought which had prevailed in these areas during the previous three months.

Bengal and Burma, on the other hand, received favourable rain and the season in Upper Burma was the most favourable since its conquest. Southern India (chiefly the coast districts) obtained moderately abundant rain. Over nearly the whole of the interior of India, including North-Western and Central India and the North Deccan, the period was remarkably dry, skies exceptionally free from cloud and rainfall *nil*.

The following gives a brief statement of the chief features of the meteorology of the year :—

(1) The cold-weather precipitation was more or less considerably below the normal over India (excepting North-Eastern India) and the plateau area of Baluchistan, Afghanistan and Iran. The period was throughout rainless in Rajputana and Sind.

(2) Weather was drier and hotter than usual in March and May but was very disturbed in April, more especially in the Peninsula which received a heavy burst of rain from thunderstorms between the 10th and 24th. The rainfall of the whole season was more or less in defect over North-Western and Central India and parts of Bengal and in excess in the remainder of the country, due chiefly to the heavy rainfall of April.

(3) The monsoon currents advanced about the usual time into India and gave abundant rain to the whole of Northern and Central India during the second half of that month. The current in the Arabian sea then decreased in intensity and was remarkably feeble during the remainder of the season. It gave practically no rain to the northern half of its field, including Kathiawar, Gujarat, West Rajputana, West Central India, Berar, Khandesh and the West Central Provinces and only light to moderate rain of little agricultural value in the Deccan. The Bay current was vigorous in June and July but gradually fell off in August and was below its normal strength in September. The rainfall due to it was on the average of the period in excess over Burma and North-Eastern India, and in defect in the western half of the Gangetic Plain.

(4) The retreating monsoon current in the Bay was weaker than usual and was determined in October chiefly to Burma and Bengal. The season in Upper Burma was the most favourable since its conquest. The rains of the retreating monsoon failed almost completely over the greater part of the Peninsula, thus intensifying the drought which had obtained in these areas during the previous three months.

1900. *The cold-weather period.*—Weather was less disturbed and drier than usual in January. It was, on the other hand, unsettled in February in North-Western India due to the advance of a series of feeble cold-weather depressions across Baluchistan and Northern India during the month. The precipitation of the month was generally below the normal over the plains of Northern India.

The snowfall of the period was less than usual in Baluchistan, Afghanistan and the West Himalayas. The rainfall of the period was scanty in North-Western and Central India, but was above the normal in the eastern and central districts of the Central Provinces, Bihar and Chota Nagpur, which received thundershowers from two disturbances in Northern India during the last fortnight of January.

The hot-weather period.—The rainfall of March was largely in defect over nearly the whole of India. Three depressions, the first and the second originating in the Persian area, crossed Northern India during the month. They gave no rain except in Baluchistan, Kashmir, the Punjab hills and the North Punjab, which received moderate showers during their advance across North-Western India. North and East Bengal and Assam had moderate rain during two periods of thunderstorms. Over a large part of India, including the Gangetic Plain, Chota Nagpur, Rajputana, Western and Southern India, the rainfall was absolutely or practically *nil*.

April was more disturbed than usual over the whole of India. A succession of four depressions formed in Baluchistan or Sind and passed eastwards across North-West India. The advance of each depression was accompanied with series of duststorms in the plains and thunderstorms in the lower ranges and snowstorms in the higher ranges of the Kashmir and Punjab Himalayas. The third depression gave a late and heavy fall of snow down to comparatively low elevations. The snowfall of the month in the Western Himalayas was hence considerably larger than usual. The rainfall of the month was in considerable defect in Burma and normal in Bengal. It was in excess over nearly the whole of the remainder of the area, more especially in North-Western and South India. The most important feature of the precipitation was the late and heavy snowfall in the Western Himalayas. A noteworthy feature of the month was the severity of the hailstorms and thunderstorms which occurred in Assam. The most remarkable storm occurred in the Goalpara district on the 18th. This storm or tornado extended over a narrow belt, not more than half a mile in width and 30 or 40 miles in length. It destroyed everything over which it passed, injuring or killing a large number of people.

May was hotter than usual. A cyclonic storm passed into Lower Burma from the Bay on the 5th and was followed by moderate rain during the next two days. Frequent thunderstorms occurred in Bengal and Assam during the second and third weeks of the month. The rainfall of the month of May was considerably below the normal over by far the greater part of the country. It was more or less considerably in defect over the Peninsula and in slight to moderate defect over the greater part of Burma and North-Eastern India.

The rainfall of the period was more or less above the normal in Assam, the United Provinces hills, the South-East, North and West Punjab, Rajputana and Madras and normal or in defect elsewhere. The deficiency was largest, relatively to the normal, in Arakan, Berar, the Konkan and Khandesh.

The south-west monsoon period.—The south-west monsoon current was established in the Arabian Sea later than usual and was considerably below its normal strength until nearly the end of July. It began to give heavy rain on the Malabar Coast from the 12th June and was strong until the 20th, when it fell off considerably in intensity. The current strengthened again on the 24th and advanced northwards up the Konkan Coast as far as Bombay. The rainfall also extended during the period into the interior of the peninsula and the Central Provinces. Practically no rain fell in June over the large area comprising Gujarat, Kathiawar, Central India, West Rajputana, Sind and the South and West Punjab.

The Bengal current was established at the head of the Bay on the 10th and 11th June and advanced up the Gangetic Plain as far as Bihar during the next five days. A further advance which occurred in the last week of the month carried the rains over the greater part of the Gangetic Plain and the East Punjab.

The Bombay current was weak during the first ten days of July. It increased on the 11th and advanced in moderate strength between the 11th and 16th over a considerable part of North-Western India. A second partial break occurred from the 19th to the 26th followed by a strong and fairly steady advance up to the limits of its extension in the Punjab. The current was, during the next two months, stronger than usual and gave general and heavy rain over the whole of North-Western and Central India and the North Deccan.

The Bay current was of normal strength in July, but was diverted more largely than usual to North-Eastern India. During the months of August and September, when the Bombay current was strong, the Bay current was diverted to some extent from Assam and North and East Bengal and more largely determined than usual to the Gangetic Plain and Central India.

On the mean of the period the rainfall was practically normal in the Indian area and on the whole favourably distributed for agricultural operations, and terminated the operations for famine relief over the greater part of the country seriously affected by drought in the previous year.

The retreating south-west monsoon period.—The south-west monsoon currents in the Bay withdrew much earlier than usual from the Bay area. In the first week of October weather was showery in Burma and Southern India and fine and dry elsewhere. There were two periods of stormy weather in the Bay during the month. The first disturbance was a cyclonic storm of moderate intensity which advanced into Orissa and Bengal and gave a heavy downpour of rain from the 6th to the 12th. The Madras coast districts received frequent moderate rain from the 12th to the 19th. The second disturbance of the month, of feeble intensity, advanced from the centre of the Bay on the 22nd to the Coromandel coast on the 24th, and broke up in North Mysore on the 25th. It gave a moderate burst of rain to Southern India from the 24th to the 27th.

Weather was exceptionally fine and free from storms in the Bay in the months of November and December. Three feeble depressions advanced from Persia and Baluchistan into Upper India in the second half of December. They were of slight importance except the second of the series. This formed over Persia on the 20th, passed through

Baluchistan on the 21st and across Upper India on the 23rd and 24th. It gave some rain in the Punjab plains and a moderately heavy fall of snow in the Punjab and Kashmir Himalayas.

The chief features of the whole period were the scanty rainfall over the greater part of the Peninsula and Lower Burma and the abnormally early withdrawal of the monsoon current from the Bay area in the last week of October six weeks earlier than usual. The rainfall was especially deficient in the Madras coast districts and Southern India.

The following summarizes the chief features of the meteorology of the year :—

(1) Weather was finer and drier than usual during the cold-weather and the precipitation was more or less below the normal over the greater part of Northern India, more especially Rajputana and Sind, which obtained less than 5 per cent. of their normal fall.

(2) March was drier than usual. April and the first fortnight of May were, on the other hand, disturbed and the precipitation was largely in excess over the Indian area except Burma. The chief feature of the period was a moderate and late general fall of snow in the Western Himalayas in April, in consequence of which the snow accumulation was somewhat above the normal at the end of May. Weather was very hot and dry in the latter half of May.

(3) The Bay current was strong throughout and gave abundant rain chiefly to Burma and North-East India until the end of July, and to the Gangetic Plain and Upper India in August and September. The Arabian Sea current was at first weak and extended very slowly into Upper India but was unusually steady throughout August and September and gave abundant rain. The rainfall of the period was hence on the whole favourable for the staple crops and well-distributed, more especially in the Punjab, Rajputana, the Central Provinces, the Deccan, North-Eastern India and Burma.

(4) The monsoon currents retreated from North-Western India somewhat later than usual and a month to six weeks earlier than usual from the Deccan. The Bay current was feeble and withdrew from that area about six weeks before the normal date. The rainfall of the period was scanty and in large defect over the Peninsula (more especially the Deccan area) and in considerable defect in Burma and North-Eastern India.

1901.—*The cold-weather period.*—Weather was finer and more settled than usual throughout the period in the Persian area, and the number of cold-weather depressions which entered India from that region was much below the normal. On the other hand, there was a marked tendency to the formation of shallow depressions in Kathiawar, Gujarat and the adjacent parts of the Arabian Sea. These disturbances advanced eastwards and gave moderate rain, chiefly accompanying thunderstorms. Three well-defined depressions affected the weather in January, of which two formed in Kathiawar and the adjacent land and sea areas. Four depressions crossed Northern India in February, three of which formed in North Bombay.

The distribution of the precipitation of the period was hence very unusual. The total rainfall of the period was in marked defect in Persia, Afghanistan and Baluchistan and also in Assam and East Bengal. On the other hand, it was in moderate to large excess over Burma, the greater part of North-Eastern and Central India and the Peninsula.

generally, many districts in the latter area receiving as much as five to fifteen times the small normal fall of the period.

The hot-weather period.—March was more disturbed than usual. A series of five depressions advanced across Northern India during the month, of which four were well-defined and formed in North Bombay. The first storm gave a heavy fall of snow over the Western Himalayas and moderate rain in Upper and Central India during the first week of the month. The fourth storm gave moderately heavy snow from the 29th to the 31st in the Western Himalayas and moderate rain in the Punjab. The rainfall of the month was in slight excess in North-Western India, and in moderate to large defect in North-Eastern India (more especially in Assam).

April was drier than usual over nearly the whole of Northern India and in Burma. The rainfall of the month was scanty and below the small normal of the month throughout the country except locally in Bombay, the Central Provinces and parts of Bengal and Assam The only important feature of the month was a cyclonic storm which formed unusually early in the season in the extreme south of the Arabian Sea. Its existence was first shown on the 24th of the month. It advanced in a general northerly direction to the head of the Arabian Sea, crossed the Mekran coast on the 3rd of May and broke up over the Baluchistan and Afghanistan hills, to some parts of which it gave a deluge of rain, falls ranging from 3 to 11 inches in 24 hours occurring at a large number of stations in the Punjab frontier districts and Baluchistan. This rainfall was phenomenal in its amount and character, occurring as it did in the driest area in India, where the mean normal rainfall of May ranges between a tenth of an inch and three inches. The consequent floods swept away the cold-weather crops in process of being harvested from many of the valleys in the frontier districts. Weather was much less disturbed than usual during the remainder of the month, and the rainfall of the month was hence in general defect over the whole Indian area, except the districts directly affected by the cyclonic storm of the first week of May, *i.e.*, the Indus Valley districts, East Baluchistan and Afghanistan.

The rainfall of the hot weather period was more or less in defect over nearly the whole Indian area. The defect was most marked, on the whole, in Assam and Arakan. The precipitation of the period was more or less above the normal in Baluchistan, Afghanistan and the frontier districts of the Punjab, due mainly to the cyclonic rainfall of the first week of May.

The south-west monsoon period.—The rains began on the West coast towards the end of the second week of June, and were feeble and intermittent during the remainder of June and the first half of July. The Arabian Sea current was of about normal strength during the last ten days of July and in August, but was feeble in September and withdrew from Upper India considerably earlier than usual. The Bay current was in June and the first half of July slightly weaker and more unsteady than usual and was mainly determined to Burma and North-East India. It was of normal strength in August and gave satisfactory rain to Northern India, but was feeble in September. The rains commenced late in the United Provinces and the Punjab, but during the latter half of July and in August were, on the whole, favourably distributed. They terminated unusually early in September, especially in the western half of the Gangetic Plain. The rainfall of the period was abundant in the West coast districts south of Bombay, but was deficient over the

remainder of the field of the Arabian Sea current. The deficiency was large and serious in Khandesh, Rajputana, Gujarat, Kathiawar, Cutch and Lower Sind; moderate in the Central Provinces; and slight to moderate in the interior of the Peninsula. The rainfall of the period was favourable over the greater part of North-East India and in Burma.

The retreating south-west monsoon period.—Weather was more disturbed than usual in the Bay during the months of October and November and a series of four storms formed in that area. One of the two storms which were initiated in October advanced westwards to Kathiawar. The two storms which formed in the second half of November followed a very unusual course passing north into Bengal, so that North-East India and Burma obtained heavy and untimely rain during this period. In the south of the Peninsula the rainfall was on the whole practically normal.

The total rainfall was practically *nil* in North-Western and Central India and in North Bombay and was more or less below the normal over the north and centre of the Peninsula, the percentage deficiency being greatest in the northern districts. The rainfall of the period was, on the other hand, in moderate excess in Burma, Assam and East Bengal.

The following gives a summary of the more important features of the rainfall distribution of the year :—

(1) The cold-weather season was drier than usual in Persia, Baluchistan and North Bombay. The precipitation of the period was, on the other hand, above the normal in the plain and hill districts of the Gangetic Plain, and in Central India and the North Deccan.

(2) The hot-weather period was drier and hotter than usual, and the rainfall in general defect, more especially in Assam. A cyclonic storm of unusual character in the first week of May gave an extraordinarily heavy downpour of rain in the Indus frontier districts, Baluchistan and Afghanistan.

(3) The Bay monsoon current was throughout the first half of the period weaker and more unsteady than usual, and was mainly determined to Burma and North-East India. It was of normal intensity in August but was feeble in September. The Bombay current set in later than usual and was weak until the middle of July when it strengthened and advanced to Upper India. The current was of normal strength in August and feeble in September. The rains were unusually late in commencing and also terminated much earlier than usual over a large part of North-Western India, and the total precipitation was much below the normal. These conditions not only seriously affected the summer crops but also largely diminished the area sown with the cold-weather crops in the unirrigated districts of North-Western and Central India.

(4) The period October to December was abnormally dry over the greater part of India. The retreating current withdrew from the Bay upwards of a week earlier than usual. Burma, Assam, East and South Bengal and the West coast districts of the Bay had slightly heavier rainfall than the normal.

1902.—*The cold-weather period.*—January and February were unusually dry over the greater part of the country, and the total precipitation of the cold-weather season was small in amount and much below the average over nearly the whole of Northern India.

The winter snowfall was unprecedentedly light and very largely below the normal in the extensive mountain region bordering North-Western India on the north and west.

The hot-weather period.—This period was, on the whole, somewhat drier than usual; but the rainfall deficiency was much smaller in percentage amount than in the previous period.

A series of four depressions and feeble disturbances, chiefly of the cold-weather type, passed across Northern India during March. Three at least advanced from Persia, and gave light but fairly general rain in Northern India.

Weather in April was also somewhat more disturbed than usual, more especially in North-Eastern India, which received frequent rain from thunderstorms. The rainfall of the month was hence in large excess in that area. Bengal and Orissa received nearly three times their normal amount and Assam 45 per cent. more than usual. The hill districts of Upper India had also frequent thundershowers, and the rainfall was hence considerably above the normal. Over the remainder of India the rainfall was below the normal, the percentage deficiency being greatest in the Punjab plains, Rajputana and the West coast of India, in each of which areas it was about 75 per cent.

Weather was unusually disturbed in May over the Arabian Sea and Bay of Bengal in each of which areas a cyclonic storm formed during the first fortnight of the month. The storm in the Bay originated between the Andamans and the Pegu coast on the 4th and advanced northwards into Central Burma on the 7th. It gave a heavy burst of rain to Tenasserim and Lower and Central Burma. It was the most severe storm that has visited Lower Burma during the past 30 years. The British Indian steamer *Camorta* with upwards of 600 passengers, and the S.S. *Hermod* foundered off the Burma coast during the storm. The storm in the Arabian Sea formed on the 5th and 6th to the south-east of Socotra and advanced during the next eight days along a curved path to the Sind coast which it crossed on the 13th. The S.S. *Ehrenfels* foundered with all hands on the 9th off the coast of Socotra.

Tenasserim and Lower and Central Burma obtained heavier rain than usual during the month, due partly to the heavy burst of rain accompanying the first cyclonic storm of the month. Sind received a moderate burst of rain from the second cyclonic storm of the month.

The rainfall of the hot-weather period was more or less in defect over the whole of the Indian Empire, with the exception of Tenasserim, Lower and Central Burma, Cachar, Bengal, North Bihar, parts of the Punjab and of the United Provinces, Sind, South Madras and South-Central Madras and Mysore. The excess was most marked in East and Deltaic Bengal, due largely to frequent rain in April. The deficiency, on the other hand, was greatest in actual amount in the coast districts of Malabar and Arakan and, relatively to the normal, in Gujarat and parts of the United Provinces and the Central Provinces.

The south-west monsoon period.—The south-west monsoon currents, more especially the Bombay current, were much weaker than usual during June, July and the first two weeks of August The first advance of the Arabian Sea current occurred in the second week of June on the Bombay coast and was accompanied by the formation and advance of a severe cyclonic storm from about Lat. 19° N. and Long 70° E. to the Sind coast. A feeble depression formed in the Bay about the same time and initiated the rains in Bengal.

The monsoon current withdrew from the east and centre of the Arabian Sea on the 16th and 17th June and a break in the rains set in over Western and North-Western India. A fresh advance commenced in the Arabian Sea on the 3rd of July. It gave more or less general rain in the West coast districts as far north as Gujarat and to Berar, the Central Provinces and Central India.

A cyclonic storm formed in the north-west of the Bay on the 13th and 14th July. It advanced north-westwards into the United Provinces and gave more or less general rain in Orissa, Bengal, the United Provinces and Central India. A second storm formed in the same area on the 27th and followed practically the same track during the next week.

Both currents were very weak during the first fortnight of August and a general break in the rains obtained over nearly the whole of the interior. Conditions changed rapidly on the 17th and 18th and a strong influx of humid winds set in which lasted until the end of September. The distribution of the rainfall during this period was largely conditioned by the tracks of a series of moderately severe cyclonic storms which formed in the north-west angle of the Bay and passed in rapid succession landwards along more northerly tracks than usual. Three of these storms passed into North Bombay and Rajputana and one into Bihar.

The rainfall of the whole period was in considerable defect in the Central Provinces, the Deccan, West Rajputana and the southern, submontane, and hill districts of the Punjab and was in marked excess in Sind and the central coast districts of Madras It was practically normal in Bengal, the Gangetic Plain, Central India, East Rajputana and the interior of Madras. The rains terminated unusually early in the Central Provinces, and the rice crops in the eastern districts hence failed to come to maturity.

The retreating south-west monsoon period.—The chief features of the meteorology of this period were the early withdrawal of the humid monsoon currents in the second week of October from North-Eastern India and in the third week from Burma, abundant rainfall over the greater part of the Peninsula due to the unusually steady determination of the Bay monsoon current from the middle of October to December to the west and south-west coasts of the Bay, the occurrence of three storms in the Arabian Sea in October and December which gave much rain in the west coast districts and the Deccan, and the frequent passage of shallow cold-weather depressions in October and November across Baluchistan into Upper India giving cloud and light rain, followed by finer and drier weather than usual in December. The total rainfall of the period was more or less in excess in the Peninsula. The excess was unusually large in South Madras and the Coromandel coast districts. The rainfall of the period was in general defect over nearly the whole of Northern and Central India, the Central Provinces and Burma. The deficiency was most pronounced in the eastern districts of the Central Provinces, Upper and Central Burma and Bengal where the crops suffered to some extent.

The most important features of the meteorology of the year 1902 were as follows:—

(1) The cold-weather season was abnormally dry and the precipitation greatly below the average over nearly the whole of Northern India and in the adjacent mountain districts. The season was, in fact, one of the driest on record.

(2) Weather was slightly more disturbed than usual in March and April in Northern India, but the accompanying precipitation was small in amount and

below the small normal of the period. Two cyclonic storms formed in the Indian Seas in the first week of May. The rainfall of the whole period was in moderate to large excess in Burma, North-East India and South India.

(3) The Arabian Sea current was established slightly later than usual on the West coast and extended by a series of feeble advances into the interior and was for some time unusually feeble. During the first two months of its period two long breaks occurred, the second of which lasted from the end of July to the 19th August when the current increased and was unusually vigorous and gave abundant rain during the next six weeks. It retreated from North-Western and Central India in the last week of September. The Bay current was established about the normal date on the Bengal coast and was of about normal strength in July and August and strong but unsteady in September. It withdrew from Bengal considerably earlier than usual. The total rainfall of the period varied but slightly from the normal over the greater part of the country, except in the Central Provinces, where the rains ended unusually early and the rice crops in the eastern districts dried off in consequence.

(4) The retreating monsoon current was determined steadily from the middle of October to December to the Peninsula which hence received abundant and favourable rain. Weather was drier than usual in Northern India and Burma, and the rainfall of the period was scanty and much below the normal in Bengal and Burma. Three cyclonic storms formed in the Arabian Sea—a most unusual occurrence.

CHIEF FEATURES OF THE DISTRIBUTION OF THE RAINFALL IN INDIA DURING THE WET PERIOD OR PERIOD OF INCREASED PRECIPITATION, 1892-94.

The following gives the variation, year by year, during the period calculated 1st by Blanford's method (B) and 2nd by utilizing the whole of the available rainfall data of the Empire (A):—

TABLE IV.

Year.	Actual variation of annual rainfall according to method		Percentage variation of annual rainfall according to method	
	A	B	A	B
	Inches.	Inches.	Inches.	Inches
1891	−5·27	−3·54	−11	− 9
1892	+3·95	+5·09	+ 9	+12
1893	+9·16	+9·07	+20	+22
1894	+7·82	+6·47	+17	+16
1895	−2·76	−2·19	− 6	− 7
Normal annual rainfall	51·70	41·09		

The means or variations in the column headed B are obtained from the data of about 450 stations carefully selected by the late Mr. Blanford as most trustworthy and also as

best representative of the local distribution of rainfall in India. In the calculation of the averages allowance is made for the area represented by each station. The percentage comparisons made by this method are probably more accurate than those obtained by method A. The variations obtained by the latter method are determined as arithmetical averages (irrespective of the extent of area represented by each station) from about 2,000 stations in 1892 to 2,400 stations in 1902. The mean rainfall of the Indian area as given by the latter method is considerably larger than that furnished by Blanford's method, as might be expected from the fact that undue weight is given to areas like Bengal provided with a very large number of raingauge stations and deficient weight to certain dry areas as, for example, Rajputana, where the number of raingauge stations was until a few years ago very small.

The data indicate a fairly regular positive oscillatory variation during the years 1892-94 which reached its maximum phase in 1893 when the mean rainfall for the whole of India was 9 inches or 22 per cent. in excess. The actual excess in volume was equivalent to 200 cubic miles of water approximately, or sufficient to fill a tank 200 miles square (the size of England) and upwards of 25 feet deep.

In the two following tables are given the variations for each season calculated by the same methods :—

TABLE V.

Year.	VARIATION OF RAINFALL DETERMINED ACCORDING TO METHOD A.					
	Dry Season.			Wet Season.		
	Cold weather, January and February.	Hot weather, March to May.	Total variation of season.	Rains proper, June to October.	Rains retreating, November and December.	Total variation of season.
	Inches.	Inches.	Inches.	Inches.	Inch.	Inches.
1891 . . .	+0·35	+0·33	+0·68	−5·50	−0·45	−5·95
1892 . . .	−0·33	+0·54	+0·21	+4·70	−0·96	+3·74
1893 . . .	+1·46	+2·78	+4·24	+4·11	+0·81	+4·92
1894 . . .	+0·45	−0·42	+0·03	+7·41	+0·38	+7·79
1895 . . .	+0·01	−0·21	−0·20	−1·90	−0·66	−2·56

TABLE VI.

Year.	VARIATION OF RAINFALL ACCORDING TO METHOD B.					
	Dry Season.			Wet Season.		
	Cold weather, January and February.	Hot weather, March to May.	Total variation of season.	Rains proper, June to October.	Rains retreating, November and December.	Total variation of season.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1891 . . .	+0·34	+0·37	+0·71	−3·73	−0·52	−4·25
1892 . . .	−0·39	−0·21	−0·60	+6·93	−1·24	+5·69
1893 . . .	+1·63	+2·72	+4·35	+3·73	+0·99	+4·72
1894 . . .	+0·48	−0·76	−0·28	+6·30	+0·45	+6·75
1895 . . .	−0·01	−0·23	−0·24	−1·60	−0·35	−1·95

The preceding data indicate that there was a strong tendency to excess of rainfall in all seasons. It was in the culminating year 1893 even more marked (relatively to the normal) in the dry than in the wet season, as is shown by the following percentage data derived from Table V:—

TABLE VII.

Year	Dry Season. Percentage variation of rainfall of India.	Wet Season. Percentage variation of rainfall of India.
1891	+ 10	−14
1892	+ 4	+ 9
1893	+73	+12
1894	+ 1	+19
1895	− 3	− 6

The meteorological conditions in India during the two seasons are practically the inverse of each other and it is hence a remarkable fact that the excess was equally marked in both seasons. I have in a previous memoir called attention to the fact that south-west monsoon seasons of abundant rainfall in North-Western India are almost invariably followed by increased precipitation during the succeeding cold-weather season. The phenomena of the period 1892–94 are a strong confirmation of the principle and suggest the explanation given in a later section.

We have next to enquire into the distribution of the rainfall and its variation over the Indian land area in each of these years.

The following table gives actual mean variation data for nine large areas or provinces arranged in two groups of divisions according as they are dependent mainly on the Bombay or Arabian Sea current or on the Bay of Bengal current for their south-west monsoon rainfall:—

TABLE VIII.

Field.	Province.	Variation from normal of annual rainfall, (Calculated by method A). 1892	1893.	1894.
		Inches.	Inches.	Inches.
Bombay current.	Bombay and Malabar Coast Districts	+7·78	+ 3·35	− 1·45
	Central Provinces and Berar	+6·87	+ 7·76	+ 9·76
	North Bombay (including Sind, Kathiawar and Gujarat)	+5·51	+ 2·37	+12·69
	Rajputana and Central India	+5·23	+ 6·04	+ 3·77
	North and West Punjab	+3·88	+ 8·09	+ 4·94
Bay current.	Bengal and Assam (including Chota Nagpur and Bihar)	+2·78	+14·35	+ 8·36
	United Provinces of Agra and Oudh	+0·79	+10·89	+23·92
	Punjab (excepting the northern and western districts)	+5·41	+ 9·52	+12·29
	Madras	+1·22	+ 8·84	− 0·97

The following table gives the variation data of the preceding table arranged and expressed as percentages of the mean or normal annual rainfall of the nine divisions:—

TABLE IX.

Field.	Province.	Variation expressed as percentage of annual rainfall in		
		1892.	1893.	1894.
Bombay current.	Bombay and Malabar Coast Districts	+12	+ 6	− 2
	Central Provinces and Berar	+15	+17	+20
	North Bombay (including Sind, Kathiawar and Gujarat)	+22	+ 9	+49
	Rajputana and Central India	+18	+21	+13
	North and West Punjab	+24	+50	+30
Bay current.	Bengal and Assam (including Bihar and Chota Nagpur)	+ 4	+20	+11
	United Provinces of Agra and Oudh	+ 2	+29	+64
	Punjab (excepting the northern and western districts)	+25	+44	+56
	Madras	+ 4	+26	− 3

The following are the chief conclusions from the preceding tabular data (Tables V, VI, VII, VIII and IX):—

(1) The two methods of calculation, although furnishing different results for each of the three years, give a total excess of very approximately 20·5 inches for the period. Method B gives 20·63 inches and method A 20·93 inches, equivalent to an additional half year's supply (*vide* Table IV).

(2) In the years 1892 and 1893 the rainfall was in excess in both fields and in all the large divisions of the fields. In 1894 it was in excess in all divisions except the coast districts of the Peninsula.

(3) The excess was fairly equally distributed in the year 1892, the only abnormal feature being the largish percentage excess in the Punjab, North Bombay and Rajputana. In 1893 and 1894 the excess was more marked (1) in the Bengal field than the Bombay field, and (2) in the interior areas of the former field, more especially the East Punjab and the United Provinces, than in the coast districts. In the Bombay field it was greatest, absolutely as well as relatively, in the most interior districts, including the North and West Punjab, Rajputana, Central India, Berar and the Central Provinces.

(4) The most important feature was the excess in the most distant areas of the interior which mark the limit of the fields of the two branches of the Bengal and Bombay monsoon currents, hence indicating the abnormal extension, volume and strength of the monsoon currents in these years.

The following table, which is based on method A, gives corresponding data of the same nine large areas or provinces for the four seasons of each of these years and arranged

according as they are mainly dependent on the Bombay or Bay current for their south-west monsoon rainfall :—

TABLE X.

Field.	Province.	Variation of Rainfall in 1892.				Variation of Rainfall in 1893.				Variation of Rainfall in 1894.			
		Cold weather period, January and February.	Hot weather period, March to May.	Rainy season, proper, June to October.	Retreating south-west monsoon period, November and December.	Cold weather period, January and February.	Hot weather period, March to May.	Rainy season, proper, June to October.	Retreating south-west monsoon period, November and December.	Cold weather period, January and February.	Hot weather period, March to May.	Rainy season, proper, June to October.	Retreating south-west monsoon period, November and December.
		Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins	Ins.	Ins.	Ins.	Ins.
Bombay current.	Bombay and Malabar Coast Districts.	−0·03	+3·09	+6·62	−1·90	+0·28	+3·59	−1·02	+0·50	+0·25	−0·07	+ 0·25	−1·88
	Central Provinces and Berar.	−0·31	−1·38	+8·77	−0·21	+2·19	+3·65	+0·82	+1·11	−0·04	−1·02	+10·17	+0·65
	North Bombay . .	−0·24	−0·26	+6·11	−0·09	+0·50	0	+0·87	+1·00	+0·08	−0·34	+13·07	−0·12
	Rajputana and Central India.	+0·23	−0·32	+5·31	+0·01	+0·88	+1·18	+2·73	+1·24	+0·30	−0·50	+ 3·07	+0·91
	North and West Punjab	−1·58	−2·18	+7·49	+0·16	+2·60	+1·12	+4·17	+0·20	+1·72	+0·24	+ 3·12	−0·15
Bay current	Bengal and Assam .	−0·58	+3·52	−0·53	+0·38	+2·15	+4·96	+7·90	−0·65	−0·34	−0·37	+ 7·22	+1·85
	United Provinces of Agra and Oudh.	+0·01	−1·03	+1·99	−0·18	+1·81	+1·41	+7·66	+0·02	+1·25	−0·87	+21·06	+2·48
	Punjab (excepting the northern and western districts).	−0·70	−0·97	+6·72	+0·36	+3·37	+0·87	+5·46	−0·17	+2·49	−0·59	+ 8·11	+2·27
	Madras . . .	−0·27	−1·60	+8·58	−5·49	+0·32	+2·12	+1·65	+4·76	+0·25	−0·31	+ 1·51	−·42

The following gives the preceding data expressed as percentage variations :—

TABLE XI.

Field.	Province.	Percentage variation of Rainfall in 1892.				Percentage variation of Rainfall in 1893.				Percentage variation of Rainfall in 1894.			
		Cold weather period, January and February.	Hot weather period, March to May.	Rainy season, proper, June to October.	Retreating south-west monsoon period, November and December.	Cold weather period, January and February.	Hot weather period, March to May	Rainy season, proper, June to October.	Retreating south-west monsoon period, November and December.	Cold weather period, January and February.	Hot weather period, March to May.	Rainy season, proper, June to October	Retreating south-west monsoon period, November and December.
Bombay current.	Bombay and Malabar Coast Districts.	− 18	+ 67	+ 12	−62	+147	+ 88	− 2	+ 18	+139	− 2	0	− 67
	Central Provinces and Berar.	−43	−90	+20	−24	+296	+279	+ 2	+125	− 5	−74	+22	+ 82
	North Bombay . .	−75	−63	+25	−50	+161	0	+ 3	+455	+ 27	−79	+52	− 57
	Rajputana and Central India.	+35	−39	+20	+ 3	+169	+164	+10	+344	+ 50	−68	+12	+ 217
	North and West Punjab	−76	−76	+71	+24	+126	+ 40	+40	+ 29	+ 75	+ 9	+ 30	− 23
Bay current.	Bengal and Assam .	−39	+27	− 1	+44	+150	+ 39	+14	− 76	− 23	− 3	+12	+210
	United Provinces of Agra and Oudh.	+ 1	−75	+ 6	−43	+151	+107	+22	+ 5	+103	−66	+61	+590
	Punjab (excepting the northern and western districts).	−40	−54	+37	+78	+198	+ 49	+30	− 40	+146	−34	+45	+493
	Madras . .	−51	−49	+ 38	−76	+ 57	+ 66	+ 7	+ 64	+ 45	−10	+ 7	− 32

The following inferences are derived from an examination of the data of the two preceding tables:—

(1) The rainfall was in general defect in the dry season of 1892, following the weak monsoon with decreased rainfall of 1891, when Rajputana and the adjacent areas suffered more or less severely from drought.

(2) The south-west monsoon rainfall of 1892 (June to October) was in general excess by percentage amounts increasing from the Bengal and Bombay coast districts to the interior.

(3) The rainfall of 1893 was in general excess. The percentage excess was very large in all divisions for the dry season, and moderate in amount for the south-west monsoon. It was also large in the retreating monsoon over the whole of India except North-East India and the Punjab.

(4) The rainfall of 1894 was generally in moderate excess in the cold weather, but more or less considerably in defect in the hot weather. It was, on the other hand, generally in moderate to large excess throughout the whole of the wet season, the excess being most marked in the interior districts.

The period of this general excess of rainfall in the Indian area hence extended from the south-west monsoon of 1892 to the end of the south-west monsoon of 1894. It may again be noted that it followed deficient rainfall in the preceding dry season, and south-west monsoon period.

The following table gives available rainfall data for the period 1892—1894 of a considerable number of Extra-Indian stations which, with the exception of Singapore, Penang and Mauritius, are maintained by the Government of India:—

TABLE XII.

Station.	Variation of annual rainfall from normal.				Percentage variation of annual rainfall.		
	1892.	1893.	1894.	Total of period.	1892	1893.	1894.
	Inches.	Inches.	Inches	Inches.			
Baghdad	— 7·69	— 2·99	+13·27	+ 2·59	—85	— 33	+147
Teheran			+ 1·04	+ 1·04			+ 11
Ispahan			+ 2·08	+ 2·08			+ 57
Meshed		— 4·80		— 4·80		— 58	
Bushire	— 3·77	+ 4·82	+14·50	+15·55	—31	+ 40	+120
Jask		— 1·81	+ 5·02	+ 3·21		— 41	+113
Quetta	— 2·72	+ 3·27	+ 6·98	+ 7·53	—25	+ 31	+ 5
Chaman		+ 0·75	+ 3·13	+ 3·88		+ 12	+ 50
Kalat		+ 6·29	+ 6·76	+13·05		+109	+117
Kabul			+ 0·29	+ 0·29			+ 2

TABLE XII—*concld.*

STATION.	VARIATION OF ANNUAL RAINFALL FROM NORMAL.				PERCENTAGE VARIATION OF ANNUAL RAINFALL		
	1892.	1893.	1894.	Total of period.	1892.	1893.	1894.
	Inches.	Inches.	Inches.	Inches.			
Gilgit		+ 0·27	+ 1·38	+ 1·65		+ 6	+ 29
Kashgar			+ 4·38	+ 4·38			+110
Port Blair	−22·84	−21·41	+ 0·16	−44·09	−19	− 18	0
Singapore	+ 7·66	+23·25	−14·27	+16·64	+ 8	+ 24	− 15
Penang	− 7·96	− 3·67	−48·90	−60·53	− 7	− 3	− 44
Zanzibar	− 8·17	+16·84	+ 1·04	+ 9·71	−:5	+ 31	+ 2
Mauritius	+ 9·48	− 1·31	− 0·73	+ 7·44	+19	− 3	− 1
Muscat		− 2·38	+ 0·29	− 2·09		− 54	+ 7
Aden	− 2·67	− 1·50	+ 0·41	− 3·73	−90	− 51	+ 15
Perim	− 0·53	+ 0·66	− 1·26	− 1·13	−28	+ 34	− 66
Amini Devi		+18·24		+18·24		+ 38	
Minicoy	− 7·89	+ 5·24	− 7·38	− 2·14	−14	+ 9	− 13

The preceding data establish that the precipitation was in general excess over the whole area including India, Baluchistan, Afghanistan and Persia and in the areas of the Indian Ocean represented by Zanzibar and Mauritius. This feature was independent of season and was as a matter of fact even more marked in the dry season than the wet season in India, which is noteworthy considering the contrast of conditions and of atmospheric movement in that large area during the two periods of the year.

The data show that amidst a certain amount of irregularity from year to year the total rainfall of the triennial period 1892—1894 was more or less largely in excess in the Euphrates Valley, Baluchistan, and probably in Afghanistan and Central Asia (as indicated by Kashgar) as well as in India. It is noteworthy that it was in large defect at Port Blair (an illustration of a general principle that the rainfall in the Indian sea area frequently varies inversely with that of the Indian land area) and Penang, and in largish percentage defect at the three Arabian stations of Muscat, Aden and Perim. The data hence show that the feature of excessive rainfall extended over a much larger area than India.

Over the whole area to the north-west of India the rainfall occurs chiefly during the winter season from October to February or March. The following tables give

variation data (actual and percentage) of the years 1892—1894 for two periods of the year:—

TABLE XIII.

STATION.	ACTUAL RAINFALL VARIATION.					
	COLD WEATHER PERIOD, NOVEMBER TO FEBRUARY.			SUMMER SEASON, MARCH TO OCTOBER.		
	1892-93.	1893-94.	1894-95.	1892.	1893.	1894.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Baghdad		+5·94	+ 1·97		—1·92	+4·10
Bushire	—0·78	+5·73	+12·22	—1·46	—0·10	+0·35
Jask		+1·89	+ 3·10		—0·74	
Quetta	+9·20	+4·87	— 1·83	—2·41	—3·01	+0·60
Chaman	+5·75	+0·42	— 2·05		—1·26	+2·02
Kalat	+5·82	+2·91	— 0·48		—0·94	+2·71
Gilgit		+0·19	+ 0·32		+0·68	+0·82

TABLE XIV.

STATION.	PERCENTAGE VARIATION OF RAINFALL.					
	COLD WEATHER PERIOD, NOVEMBER TO FEBRUARY.			SUMMER SEASON, MARCH TO OCTOBER.		
	1892-93.	1893-94.	1894-95.	1892.	1893.	1894.
Baghdad		+97	+ 32		—66	+140
Bushire	— 7	+55	+116	—91	— 6	+ 22
Jask		+61	+100		—55	
Quetta	+172	+91	— 34	—45	—57	+ 11
Chaman	+136	+10	— 48		—61	+ 98
Kalat	+293	+97	— 16		—34	+ 97
Gilgit		+37	+ 63		+16	+ 19

The data show that the rainfall of the year 1894 was almost as largely in excess in the summer season as in the cold-weather period. It is noteworthy that the rainfall of the summer season of 1893 and probably also that of 1892 in Persia, Afghanistan and Baluchistan was largely in defect relatively to the normal.

The agricultural value of the rainfall in India depends even more upon its distribution in time and mode of occurrence than upon the total amount during the period and hence upon a variety of factors of which the most important are:—

(1) Period of commencement of the rains.

(2) Period of termination of the rains.

(3) Occurrence of prolonged breaks in the rains.

(4) The character of the falls, whether chiefly occasional cyclonic downpours or moderate rain at frequent intervals.

The following gives normal data for (1) and (2) in the areas dependent upon the Bay current.—

TABLE XV.

PROVINCE OR AREA.	Average date of commencement of monsoon rains.	Average date of termination of monsoon rains	Length of normal period of south-west monsoon rains in weeks.
North Madras (Ganjam and Circars)	7th June	26th November	25
Lower Burma	9th "	11th "	22
Upper Burma	19th "	31st October	21
Bengal	15th "	31st "	20
Bihar	15th "	15th "	17⅓
Chota Nagpur	15th "	15th "	17⅓
United Provinces, East	16th "	10th "	17
United Provinces, West	25th "	26th September	13½
East Punjab	30th "	15th "	11

The following gives corresponding data for the areas served by the Bombay or Arabian Sea current:—

TABLE XVI.

PROVINCE OR AREA.	Average date of commencement of monsoon rains	Average date of termination of monsoon rains.	Length of normal period of south-west monsoon rains in weeks.
Malabar	3rd June	15th November	24
Konkan	5th "	20th October	20
Central Provinces	10th "	15th "	18
Central India	15th "	30th September	15⅔
Gujarat and Kathiawar	15th "	24th "	14½
Rajputana	15th "	20th "	14

The preceding data establish that the period of the south-west monsoon rains decreases very considerably in passing from the coasts into the interior districts, and is in fact only about half as long in the Punjab as in the Bombay and Bengal Coast districts.

In the Appendix will be found (in Tables 39 and 40, Appendix) the approximate dates of the commencement and termination of the rains in different parts of India in each year of the period 1892-1902.

The following table gives the variations in the dates of commencement and termination of the monsoon rains in fifteen large divisions during each year of the wet period 1892-94 in weeks. A positive sign in the first three columns indicates that the rains began earlier and in the second three columns that they ended later than usual and a negative sign in

the first three columns that the rains commenced later and in the second three columns that they ended earlier than usual :—

TABLE XVII.

	Variation in the dates of commencement of the monsoon rains in			Variation in the dates of termination of the monsoon rains in		
	1892.	1893.	1894	1892.	1893.	1894.
Field of Bengal current.						
Lower Burma	+ 2 weeks	Normal	+ 1 week	Normal	— 2 weeks	— 4 weeks
Upper Burma	+ 1 week	Normal	Normal	Normal	Normal	— 2 „
Bengal	+ 1 „	Normal	Normal	Normal	— 1 week	+ 1 week
Bihar	+ 1 „	Normal	Normal	+ 2 weeks	+ 1 „	+ 3 weeks
Chota Nagpur	+ 1 „	Normal	Normal	+ 2 „	+ 1 „	+ 3 „
United Provinces, East	+ 1 „	Normal	Normal	— 2 „	+ 1 „	+ 4 „
United Provinces, West	+ 3 weeks	Normal	+ 1 week	Normal	+ 3 weeks	+ 6 „
East Punjab	+ 3 „	+ 1 week	+ 2 weeks	+ 1 week	+ 1 week	Normal
North Madras	+ 1 week	— 1 „	Normal	— 3 weeks	— 2 weeks	— 2 weeks
Field of Bombay current.						
Malabar	+ 1 week	Normal	Normal	— 1 week	+ 1 week	Normal
Konkan	+ 1 „	Normal	Normal	+ 2 weeks	Normal	+ 1 week
Central Provinces	+ 1 „	— 1 week	Normal	— 2 „	Normal	+ 3 weeks
Central India	+ 1 „	Normal	+ 1 week	Normal	+ 2 weeks	+ 5 „
Gujarat and Kathiawar	+ 1 „	Normal	Normal	Normal	+ 1 week	+ 5 „
Rajputana	+ 1 „	— 1 week	+ 1 week	+ 1 week	Normal	— 1 week

It may be noted that if the variation be less than four days it is termed normal, if from four to ten days it is given as one week, if from eleven to seventeen days as two weeks, etc.

The following table gives the normal length of the monsoon rains in each of the divisions adopted in the preceding tables and the variations from that normal in each of the three years 1892-94 :—

TABLE XVIII.

Field.	Province or Area.	Normal length of monsoon period.	Variations in the length of the monsoon period.		
			1892	1893.	1894
Bengal Current	Lower Burma	22 weeks	+2 weeks	—2 weeks	— 3 weeks
	Upper Burma	21 „	+1 week	0	— 2 „
	Bengal	20 „	+1 „	—1 week	+ 1 week
	Bihar	17½ „	+3 weeks	+1 „	+ 3 weeks
	Chota Nagpur	17½ „	+3 „	+1 „	+ 3 „
	United Provinces, East	17 „	—1 week	+1 „	+ 4 „
	United Provinces, West	13½ „	+3 weeks	+3 weeks	+ 7 „
	East Punjab	11 „	+1 „	+2 „	+ 2 „
	North Madras	25 „	—2 „	—3 „	— 2 „

TABLE XVIII—*concluded.*

Field.	Province or Area.	Normal length of monsoon period	Variations in the length of the monsoon period.		
			1892.	1893.	1894
Bombay Current	Malabar	24 weeks	0	+ 1 week	0
	Konkan	20 „	+ 3 weeks	0	+ 1 week
	Central Provinces	18 „	— 1 week	— 1 week	+ 3 weeks
	Central India	15½ „	+ 1 „	+ 2 weeks	+ 6 „
	Gujarat and Kathiawar	14½ „	+ 1 „	+ 1 week	+ 5 „
	Rajputana	14 „	+ 2 weeks	— 1 „	0

The data of the preceding two tables show a marked tendency in the three years of increased rainfall for the monsoon rains to commence earlier than usual (the amount of the acceleration being greater on the whole in the interior than in the coast districts) and also to terminate later than usual. The prolongation was on the whole greatest in the interior districts and ranged in the year 1894 between three and seven weeks in the Central Provinces, Central India, Gujarat, Kathiawar, the United Provinces, Bihar and Chota Nagpur.

On the average of all districts we have the following results. The Bengal current obtained two weeks longer than usual in 1892 and 1894 and two days in 1893 and the Bombay current one week longer in 1892, two days in 1893 and three weeks in 1894.

Hence an important feature of this period of considerably increased monsoon rainfall was that the monsoon currents set in earlier and withdrew later than usual from Northern and Central India.

The third feature, *viz.*, the length and period of occurrence of general breaks in the rains, is of great importance. The following gives data for the period 1892-94:—

TABLE XIX.

Year.	Month	Period of break.	Area affected	Character of break.
1892	June	19th to 28th	Practically the whole of Northern and Central India and the Central Provinces.	Complete.
1893	July	23rd to 31st	North-Western and Central India	Almost complete
1893	August	13th to 22nd	Ditto ditto	Ditto.

The preceding data show that no break occurred in 1894 and that there was only one short break (of nine days) in 1892 and two of nine days each in 1893. Each year of the period was hence characterized by remarkably steady persistence of south-west monsoon conditions and their extension to the extreme northern limits of the Indian Empire during the whole monsoon period from the middle of June to the middle or end of September.

The fourth feature, *viz.*, that of the character of the rainfall, is much more difficult to estimate. It might perhaps be measured for a given station by the number of rainfalls exceeding say 3 inches in 24 hours and for the whole of India by giving similar data for a number of representative stations. This is done below for selected representative stations in each province in the following table.

TABLE XX.

Province.	Representative stations.	Number of occasions on which rainfall in 24 hours exceeded 3 inches during the wet season of				
		1892.	1893.	1894.	Total.	Mean annual of period.
Bombay and Malabar Coast districts.	Bombay	8	3	5	16	5·3
	Karwar	8	6	4	18	6·0
	Matheran	22	22	20	64	21·3
	Poona	3	2	0	5	1·7
Central Provinces	Nagpur	1	1	2	4	1·3
	Saugor	0	5	7	12	4·0
	Sambalpur	7	3	4	14	4·7
North Bombay	Ahmednbad	4	2	4	10	3·3
	Rajkot	1	1	6	8	2·7
	Bhuj	1	0	4	5	1·7
	Kurrachee	1	0	3	4	1·3
Rajputana and Central India.	Jaipur	4	0	0	4	1·3
	Udaipur	0	2	2	4	1·3
	Ajmer	0	0	0	0	0
North and West Punjab	Dera Ismail Khan	0	0	0	0	0
	Mooltan	2	1	0	3	1·0
Bengal and Assam	False Point	3	3	2	8	2·7
	Calcutta	0	3	0	3	1·0
	Burdwan	0	2	1	3	1·0
	Patna	2	2	3	7	2·3
	Hazaribagh	3	3	3	9	3·0
	Cherra Poonjee	44	35	35	114	38·0
	Dhubri	8	6	2	16	5·3
United Provinces of Agra and Oudh.	Allahabad	0	2	4	6	2·0
	Agra	0	1	2	3	1·0
	Meerut	0	0	2	2	0·7
Punjab (excepting the northern and western districts.)	Lahore	1	0	1	2	0·7
	Rawalpindi	1	3	0	4	1·3
	Umballa	1	1	0	2	0·7

The preceding data are interesting as showing how very irregular heavy rainfalls are in their occurrence in India. Frequent heavy downpours occur on the southern face of the Assam hills (as represented by Cherra Poonjee), the western flank of the West Ghats as represented by Matheran, and probably on the western flanks of the Arakan and Tenasserim hills and on the southern face of the Darjeeling hills and Western Himalayas.

The data of the plain stations show that in the period 1892-94 the number of heavy falls was less at Calcutta than at Jaipur, Kurrachee and Rawalpindi, stations in the driest districts of India. Again, in the Central Provinces Nagpur received only four such falls whilst Sambalpur had 14 and Saugor 12.

Hence as a general inference from the preceding data, it appears that heavy falls are as frequent in the more distant districts of the Empire as they are in the coast districts, and it is largely due to this fact probably, that the average rainfall per rainy day during the south-west monsoon period differs little in amount over the whole of India, as is shown by the following statement :—

TABLE XXI.

Field	Area.	Mean rainfall per rainy day	Ratio of actual rainfall to number of rainy days in wet season (June to December).		
			1892.	1893.	1894.
Bombay Current	Bombay and Malabar Coast districts	0·89	0·9	0·8	0·8
	Central Provinces	0·91	0·9	0·8	0·8
	North Bombay	0·94	0·9	0·9	1·1
	Rajputana and Central India	0·93	0·9	0·9	0·8
	North and West Punjab	0·81	1·0	0·9	0·8
Bengal Current	Bengal and Assam	0·89	0·9	0·9	0·9
	United Provinces of Agra and Oudh	0·92	0·9	0·9	1·0
	Punjab (excepting the northern and western districts)	0·93	0·9	0·9	0·9
	Madras	0·75	0·7	0·8	0·7

The data of the preceding table are very interesting. They indicate in the first place that the mean rainfall per rainy day is practically the same in amount over nearly the whole Indian area (excepting Madras where the conditions are different from those of Northern and Central India) and that in normal years the average fall per rainy day is very approximately 0·90 inch.

The following table gives for fuller information the normal number of rainy days during the south-west monsoon in each of the 57 rainfall divisions of India, average rainfall of the south-west monsoon and the average rainfall per rainy day, and also the

average rainfall per rainy day in the years 1892, 1893, and 1894. For this purpose a rainy day is defined as a day on which a tenth of an inch or upwards of rain is received —

TABLE XXII

Province	Division	Wet Season June to December.					
		Average normal number of rainy days	Average normal rainfall	Mean rainfall per rainy day	Actual rainfall per rainy day in		
					1892	1893	1894
			Inches.	Inches	Inches	Inches	Inches
Burma	1 Tenasserim	117·8	166·77	1·4	1·5	1·4	1·7
	2 Lower Burma Deltaic	106·3	90·37	0·9	0·7	0·7	0·8
	3 Central do	77·7	48·65	0·6	0·8	0·8	0·8
	4 Upper do	47·9	34·01	0·7	0·7	0·7	0·7
	5 Arakan	107·1	158·95	1·5	1·5	1·4	1·3
Bengal and Assam	6 Eastern Bengal	74·5	71·87	1·0	0·8	1·0	0·9
	7 Assam Surma	89·8	92·14	1·0	1·1	1·2	1·0
	8 Do Hills	92·2	106·20	1·2			
	9 Do Brahmaputra	71·3	66·10	0·9	0·9	0·8	0·9
	10 Deltaic Bengal	63·3	49·85	0·8	0·7	0·8	0·7
	11 Central do	59·0	48·54	0·8	0·7	0·8	0·8
	12 North do	67·6	82·84	1·2	1·3	1·2	1·1
	13 Bengal Hills	90·6	93·72	1·0			
	14 Orissa	60·7	51·27	0·8	0·8	0·8	0·8
	15 Chota Nagpur	59·1	45·30	0·8	0·8	0·8	0·8
	16 South Bihar	47·5	41·57	0·9	0·7	0·8	0·9
	17 North do	49·9	48·17	1·0	1·0	1·0	0·9
United Provinces of Agra and Oudh	18 United Provinces East	43·4	37·78	0·9	0·8	0·9	0·9
	19 South Oudh	39·4	35·60	0·9	0·9	1·0	1·1
	20 North do	40·7	39·28	1·0	0·9	1·0	1·1
	21 United Provinces Central	37·7	33·06	0·9	0·8	0·9	1·0
	22 Do West	28·7	23·07	0·8	0·8	0·8	0·8
	23 Do East Submontane	43·7	42·44	1·0			
	24 Do West do	40·4	43·10	1·1			
	25 Do Hills	59·0	54·33	0·9			
Punjab	26 South-East Punjab	23·1	20·24	0·9			
	27 South do	16·7	13·50	0·8	0·8	0·9	0·9
	28 Central do	16·4	14·25	0·9	0·8	0·8	0·8
	29 Punjab Submontane	24·6	24·14	1·0	1·0	1·1	1·0
	30 Do Hills	46·1	45·25	1·0	1·0	0·9	1·1
	31 North Punjab	19·6	14·34	0·7			
	32 West do	9·3	6·57	0·7	0·9	0·7	0·7
Bombay and Malabar Coast Districts (Madras)	33 Malabar	104·0	114·16	1·1	1·0	1·0	1·0
	34 Madras South Central	36·0	23·06	0·6	0·7	0·7	0·6
	35 Coorg				0·9	0·7	0·7
	36 Mysore	44·7	29·18	0·7		0·6	0·6
	37 Konkan	93·6	110·97	1·2	1·3	1·1	1·1
	38 Bombay Deccan	47·4	32·46	0·7	0·7	0·7	0·7
	39 Hyderabad North	48·2	33·89	0·7		0·8	0·7
	40 Khandesh	43·3	29·94	0·7	0·7	0·7	0·7
Central Provinces and Berar	41 Berar	42·1	30·46	0·7	0·8	0·6	0·8
	42 Central Provinces West	49·8	42·32	0·8	0·9	0·7	0·8
	43 Do, Central	54·3	48·58	0·9	0·8	0·9	0
	44 Do East	54·8	49·26	0·9	1·0	0·9	0·9
Bombay (North)	45 Gujarat	44·8	40·96	0·9	0·9	0·9	1·1
	46 Kathiawar and Cutch	30·0	27·03	0·9	0·8	0·9	1·1
	47 Sind	6·7	5·71	0·9	1·1	0·7	1·0
	48 Baluchistan Hills	7·5	3·65	0·5			
Rajputana and Central India	49 Central India East	42·9	36·20	0·8	0·9	0·8	0·8
	50 Rajputana East, Central India West	29·5	23·14	0·8	0·9	0·9	0·9
	51 West Rajputana	14·2	11·05	0·8	0·8	1·0	0·8
Madras	52 East Coast North	49·4	37·87	0·8	0·8	0·8	0·7
	53 Hyderabad South	45·0	27·39	0·6		0·7	0·6
	54 Madras Central	34·7	22·24	0·6	0·7	0·6	0·6
	55 East Coast Central	37·4	30·69	0·8	0·8	1·0	0·8
	56 Do South	45·4	37·34	0·8	0·7	0·9	0·7
	57 Madras South	31·4	22·33	0·7	0·6	0·7	0·6

Chief features of the distribution of the rainfall in India during the dry period or period of decreased precipitation from 1895—1902.

The following gives data showing the variations of rainfall in each year for the Indian land area :—

Table XXIII.

Year.	Actual variation of annual rainfall according to method		Percentage variation of annual rainfall according to method	
	A.	B.	A.	B.
	Inches.	Inches		
1895	—2·76	—2·19	— 6	— 7
1896	—5·63	—4·83	—13	— 12
1897	+1·12	—0·15	+ 2	0
1898	+0·94	+0·43	+ 2	+ 1
1899	—7·72	—11·14	17	—27
1900	—0·47	—0·57	— 1	— 1
1901	4·15	—4·13	— 9	—10
1902	- 0·86	—2·30	— 2	— 6

The preceding data show that the average rainfall of the whole Indian land area was according to the second method of calculation below the normal in seven out of the eight years, and was in abnormally large defect in two years, *viz*, 1896 and 1899. It was practically normal in the remaining year 1898. The rainfall for the whole period totalled 19·53 inches in defect according to method A and 24·88 inches in defect according to method B.

The following variation data of the annual rainfall of the Indian land area for the past 39 years show strikingly the abnormal character of the rainfall of the period. The table gives the variation of the rainfall of each year from the normal obtained by Blanford's method and also the variation of each season of the period :—

Table XXIV.

Year.	Variation of rainfall in				Variation of annual rainfall	Normal rainfall of India.
	Cold weather period, January and February.	Hot weather period, March to May	Rainy season proper, June to October	Retreating monsoon period, November and December.		
	Inch.	Inches.	Inches	Inches.	Inches.	Inches
1864	—0·02	—0·02	—5·32	—0·16	—5·52	41·09
1865	+0·40	+1·49	—2·50	—0·16	—0·77	
1866	+0·31	—0·68	—1·31	—0·41	—2·09	
1867	—0·67	+0·82	+3·77	—1·15	+2·77	
1868	+0·37	—0·34	—5·71	—0·95	—6·63	

TABLE XXIV—*concluded*

Year.	Variation of rainfall in				Variation of annual rainfall	Normal rainfall of India.
	Cold weather period, January and February	Hot weather period March to May.	Rainy season proper, June to October	Retreating monsoon period November and December		
	Inches	Inches	Inches	Inches	Inches	Inches
1869	−0 11	+0·14	+0 20	+0 17	+0 40	41 09
1870	−0 74	−1 89	+4 45	−0 33	+1 49	
1871	+1 12	+2 37	−3 39	+0·83	+0·93	
1872	−0 30	−0 09	+1 97	+0·73	+2 31	
1873	−0·10	−0 48	−3·25	−0 63	−4 46	
1874	+0 16	+0 34	+4 90	−0·76	+4 64	
1875	+0 03	−0·95	+5 53	−2 23	+2 38	
1876	−0 66	−0 45	−2 51	−0 87	−4 49	
1877	+1 27	+1 19	−7·95	+1 21	−4 28	
1878	−0 01	+0·41	+5·35	+0 59	+6 34	
1879	−0 67	+0 12	+2 33	−0 09	+1 69	
1880	+0 02	−0 03	−2 88	+1 33	−1 56	
1881	−0 19	+0·16	+0 04	+0 09	+0·10	
1882	−0 01	−0·38	+2 24	+0 79	+2·64	
1883	−0 01	−0 01	−0 12	+0 02	−0 12	
1884	−0 36	−1 03	+1 93	+1 19	+1 73	
1885	−0 05	−0·24	−0 63	+1 97	+1 05	
1886	−0·37	+0 62	+3 08	−0 31	+3 02	
1887	−0 23	+0·39	+1 36	+0 90	+2 42	
1888	+0 64	+0 25	−3 30	+0 87	−1 54	
1889	+0·04	−0 83	+4 05	−0 85	+2 41	
1890	−0·30	−0 21	+0·98	+0 21	+0 68	
1891	+0·34	+0 37	−3 73	−0 52	−3 54	
1892	−0 39	−0 21	+6 93	−1 24	+5 09	
1893	+1 63	+2 72	+3 73	+0 99	+9 07	
1894	+0 48	−0 76	+6 30	+0 45	+6 47	
1895	−0 01	−0 23	−1 60	−0 35	−2 19	
1896	−0 42	−0 82	−4 24	+0 65	−4 83	
1897	−0 01	−0 12	+0 46	−0 48	−0 15	
1898	+0 50	−1 00	+0 18	+0 75	+0 43	
1899	−0 38	+0 58	−10 02	−1 32	−11 14	
1900	−0 02	−0·25	+0 10	−0·40	−0·57	
1901	+1 47	−0 48	−5 50	+0·38	−4 13	
1902	−0 57	+0·16	−2 25	+0 61	−2 05	

The preceding data show that the period 1892—1902 was unique in many respects. The year 1893 had the greatest excess and 1899 the greatest defect of rainfall during the whole period. It was unique also in the amount of the excess of the three consecutive years 1892—1894 and also in the prolonged period and intensity of drought during the years 1895—1902.

The data also indicate that prior to 1903 the rainfall was in defect in 18 years out of 39 years, and prior to 1895, in 11 years out of 31. The rainfall varied from the normal by four inches or 10 per cent. in 13 out of 39 years. In seven years the rainfall was normal or in excess in all the four seasons, and in two years it was in excess in three seasons, the failing season being the hot period, when the weather is most largely determined by local conditions. There is hence a moderate probability based on experience that rainfall in excess or defect over the Indian area by amounts averaging over four inches is due to similar variation in every season, in the dry (more especially the cold season) as well as the wet season. In other words drought is not a seasonal but an annual or long period variation of conditions due to general and not to seasonal conditions or actions.

The seasonal variation data for the period 1895—1902 calculated by Blanford's method are contained in the first four columns of the preceding table in which the variations are determined by that method.

The following gives variation data for each of the four seasons calculated by method A based on the whole of the available rainfall information :—

TABLE XXV.

Year.	Variation of rainfall determined according to method A.				
	Dry Season.		Wet Season.		Total of year.
	Cold weather, January and February.	Hot weather, March to May.	Rains proper, June to October.	Rains retreating, November and December.	
	Inches.	Inches.	Inches.	Inches.	Inches.
1895	+0·01	−0·21	−1·90	−0·66	−2·76
1896	−0·46	−0·89	−4·93	+0·65	−5·63
1897	+0·09	−0·48	+2·71	−1·20	+1·12
1898	+0·63	−1·61	+1·44	+0·48	+0·94
1899	−0·27	+0·72	−6·60	−1·57	−7·72
1900	+0·20	−0·39	+0·24	−0·52	−0·47
1901	+1·44	−0·68	−5·46	+0·55	−4·15
1902	−0·61	+0·33	−1·20	+0·62	−0·86

The following are the chief conclusions from the seasonal data for the period 1895—1902 :—

(1) The rainfall of the Indian area was in defect in three seasons out of four in five years out of the eight. There is hence a fairly marked tendency for drought to extend over the dry as well as the wet season, and it is hence a general condition or feature and not a special seasonal feature.

This is shown more clearly by the arrangement of the data according to the wet and dry seasons, *viz.*:—

TABLE XXVI.

Year.	Variation from normal of the rainfall of the		Year.	Variation from normal of the rainfall of the	
	Dry season.	Wet season.		Dry season.	Wet season.
	Inches.	Inches.		Inches.	Inches.
1895	—0·49	— 3·90	1899	+0·20	—11·41
1896	—1·57	— 4·53	1900	—0·32	— 0·36
1897	—0·32	— 0·04	1901	+0·88	— 4·55
1898	—0·76	+ 0·66	1902	—0·40	— 1·63

The data show that in five cases out of seven deficient rainfall in the wet season was followed by deficient rainfall in the dry seasons, and that in one case increased rainfall in the former was followed by increased rainfall in the latter season. Thus in six cases out of seven, a variation in the wet season, positive or negative, was followed by a variation of similar sign in the following dry season. Hence judged from the above data, the probability that a wet season of deficient rainfall will be followed by a dry season of deficient rain is considerable to large. This is in accordance with previous experience.

The following tables give the variations in five large provinces of the field of the Bombay current and four provinces of the Bay current, firstly as actuals and secondly as percentages of the normals:—

TABLE XXVII.

	Variation of rainfall.								
	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	Total variation of period.
A. Field of the Bombay current.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Bombay and Malabar Coast districts.	—1·31	+ 3·07	+0·92	+2·18	—21·50	+0·48	— 0·90	+ 1·73	— 9·33
Central Provinces and Berar .	—4·32	+ 0·90	—3·46	—3·83	—23·41	+2·52	— 0·71	—10·68	—43·02
North Bombay . . .	—0·13	+ 1·59	—1·40	—1·36	—19·47	—3·26	—12·55	— 0·85	—43·43
Rajputana and Central India .	—7·82	— 7·74	—3·78	—5·49	—13·30	—0·02	— 8·47	— 2·43	—49·05
North and West Punjab . .	+0·51	— 3·31	+4·87	—0·22	— 5·41	+2·17	+ 1·13	— 2·64	— 2·90
Mean of whole field . .	—3·81	— 1·10	+0·63	—1·74	—16·62	+0·38	— 4·30	— 2·97	—29·53
B. Field of the Bengal current.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Bengal and Assam . . .	—6·07	—11·94	+2·25	—0·82	+ 8·82	—2·98	— 7·36	+ 2·37	—15·73
United Provinces of Agra and Oudh.	+0·18	—12·94	+3·80	+8·11	+ 1·47	—0·50	— 4·51	— 5·02	— 9·44
Punjab (excepting northern and western districts).	—4·63	— 7·16	—3·53	—2·66	—12·84	+6·15	— 4·26	— 5·22	—34·15
Madras	+2·91	— 3·3	—2·02	+4·36	— 8·12	—3·44	+ 0·35	+ 6·29	— 3·06
Mean of whole field . .	—1·90	— 8·86	+0·13	+2·25	— 2·67	—0·19	—3·95	— 0·40	—15·59

According to the data of Table XXVII, the rainfall was in defect in three out of the eight years of the period in the West Coast, in six years in the Central Provinces, in seven years in North Bombay and in all years in Rajputana. Hence the period was one of almost continuous deficiency of rain over the interior districts of the field of the Bombay current, including North Bombay, the Central Provinces, Central India and Rajputana.

The rainfall was in defect in five years of the period in Bengal, in four years in the United Provinces and Madras, and in seven years in the East and South Punjab. Hence the last named area was the only district in which the drought or deficiency of rainfall was as persistent as in the interior districts of the field of the Bombay current. In other words the drought conditions were more persistent, intense and extensive in the field of the Bombay current than the Bengal current, and the causes of these conditions are to be sought rather in the actions and conditions which determine the advance and prevalence of the large and massive Arabian Sea current than in the comparatively feeble Bay current.

The following table gives the data of the preceding table expressed as percentages of the normal annual fall in each area.—

TABLE XXVIII.

	PERCENTAGE VARIATION OF ANNUAL RAINFALL.								
	1895.	1896	1897.	1898.	1899.	1900.	1901.	1902.	Mean of eight years.
A. Field of the Bombay current.									
Bombay and Malabar Coast districts	− 2	+ 5	+12	+ 4	−36	+ 1	− 2	+ 3	− 2
Central Provinces and Berar	− 9	+ 2	− 7	− 8	−50	+ 5	− 2	−24	−12
North Bombay	−23	+ 6	− 5	− 5	−76	−12	−48	− 3	−21
Rajputana and Central India	−28	−28	−14	−20	−47	0	−31	−10	−22
North and West Punjab	+ 3	−22	+32	− 1	−36	+14	+ 7	−17	− 3
B. Field of the Bengal current.									
Bengal and Assam	− 8	−16	+ 3	− 1	+12	− 4	−10	+ 3	− 3
United Provinces of Agra and Oudh.	0	−35	+10	+22	+ 4	− 1	−12	−13	− 3
Punjab (excepting the northern and western districts).	−21	−32	−16	−12	−57	+28	−19	−24	−19
Madras	+ 9	−10	− 6	+13	−24	−10	+ 1	+19	− 1

Assuming that a deficiency of 20 to 32 per cent. in a large area in which the rainfall is between 15 inches and 60 inches is a drought of moderate intensity, a deficiency of 33 to 50 per cent. a severe drought almost certain to lead to famine and 50 per cent. or over a very severe and intense drought, the following are the chief conclusions from the preceding data:—

(1) In five out of the eight years the deficiency was over 20 per cent. in large areas, in three years over 33 per cent. and in one year over 50 per cent.

(2) In the year 1895 there was moderate drought in the area including North Bombay, Rajputana, Central India and the East Punjab, dependent chiefly or entirely on the Bombay current. The Bengal current gave normal rain and the Bombay current average rain in the coast and Peninsular districts as well as in the North and West Punjab.

(3) In the year 1896, the deficiency was more marked in the area of the Bengal current than in that of the Bombay current. The rainfall was over 20 per cent. in defect over the whole of North-Western and Central India including Rajputana, Central India, the Punjab and United Provinces, and was most largely below the normal in the United Provinces (35 per cent.) and East Punjab (32 per cent.).

(4) In 1897 the rainfall was generally normal, but was in slight to moderate defect in Rajputana and the East Punjab. The rains were generally favourable in 1898, but Rajputana and Central India continued to suffer from drought and deficient rainfall (20 per cent. in defect).

(5) The rainfall due to the Bombay current in 1899 was conspicuously scanty, the deficiency ranging between 36 per cent. in the West Coast districts and the North and West Punjab and 76 per cent. in the North Bombay division. There was a more or less complete failure over the whole of the interior of India dependent on that current. The Bengal current gave normal rain in Bengal, Assam and the Gangetic Plain, but scanty rain in the East Punjab.

(6) The rainfall was on the whole normal in amount and favourable in 1900. Both currents gave less than their normal precipitation in 1901, but the deficiency was small to moderate in amount except in the areas which had suffered most severely in 1899, *viz.*, North Bombay (48 per cent. in defect) and Rajputana and Central India (31 per cent. in defect).

The rainfall was also below the normal in both fields in 1902, but to a less extent than in 1901. It was more than 20 per cent. below the normal in two areas, *viz.*, the Central Provinces and Berar, and the East and South-East Punjab (each 24 per cent.).

(7) The most remarkable feature was the persistent tendency to large deficiency of rainfall in the area including North Bombay, Rajputana and Central India. The deficiency was 20 per cent. or upwards in five out of the eight years and averaged 22 per cent. for the whole period in Rajputana and Central India.

(8) There was also a marked tendency to the recurrence of drought in the Punjab. The deficiency exceeded 20 per cent. in four years out of eight in the East Punjab and averaged 19 per cent. for the whole period.

TABLE XXIX.

VARIATION FROM NORMAL OF RAINFALL IN

	1895.				1896.				1897.				1898.				1899.				1900.				1901.				1902.			
	Cold weather, January and February.	Hot weather, March to May.	Rainy season proper, June to October.	Retreating rains, November and December.	Cold weather, January and February.	Hot weather, March to May.	Rainy season proper, June to October.	Retreating rains, November and December.	Cold weather, January and February.	Hot weather, March to May.	Rainy season proper, June to October.	Retreating rains, November and December.	Cold weather, January and February.	Hot weather, March to May.	Rainy season proper, June to October	Retreating rains, November and December.	Cold weather, January and February.	Hot weather, March to May.	Rainy season proper, June to October.	Retreating rains, November and December.	Cold weather, January and February.	Hot weather, March to May.	Rainy season proper, June to October.	Retreating rains, November and December.	Cold weather, January and February.	Hot weather, March to May.	Rainy season proper, June to October.	Retreating rains, November and December.	Cold weather, January and February.	Hot weather, March to May.	Rainy season proper, June to October.	Retreating rains, November and December.
Field of Bombay current.	Inv.	Ins.	Ins.	Ins.	In.	Ins.	Ins.	Ins	In.	Ins.	Ins.	Ins	Ins.	Ins.	Ins.	Ins.	Ins.	ns.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	ns.	Ins.	Ins.
Bombay and Malabar Coast Districts.	−0·01	−0·37	+0·15	−1·08	−0·12	−1·03	+ 4·08	+0·19	+0·22	−0·66	+9·45	−2·08	+0·34	−0·39	+0·78	+1·45	−0·11	+2·60	−21·39	−2·60	−0·05	−1·46	+4·07	−2·09	+0·81	+0·59	− 2·92	+0·71	+0·04	−0·82	− 0·38	+2·82
Central Provinces and Berar.	+0·06	+0·36	−4·06	−0·69	−0·75	−1·04	+ 2·10	+0·58	+0·61	+0·17	−2·40	−0·87	+0·73	−0·63	−2·94	−0·79	−0·43	+0·28	−22·42	−0·87	+0·10	−0·53	+3·19	−0·61	+2·73	+0·18	− 3·06	−0·37	−0·19	−0·53	−10·10	+0·80
North Bombay . .	−0·17	−0·25	−5·52	−0·18	−0·21	−0·34	+ 1·62	+0·55	−0·21	−0·31	−0·80	−0·23	+0·13	−0·22	−1·53	−0·05	−0·31	+0·01	−18·01	−0·21	−0·30	−0·05	−2·88	−0·03	−0·13	−0·07	−12·11	−0·21	−0·21	+0·07	− 0·73	+0·03
Rajputana and Central India.	+0·38	−0·12	−7·80	−0·18	−0·50	−0·58	− 7·32	+0·67	−0·26	−0·52	−2·51	−0·49	+0·51	−0·18	−5·75	−0·10	−0·63	−0·34	−11·89	−0·41	−0·11	+0·02	+0·18	+0·22	+0·18	−0·17	− 8·01	−0·11	−0·15	−0·31	− 1·63	−0·31
North and West Punjab.	−0·01	+1·27	−0·15	0·61	−0·13	−1·21	− 1·83	−0·15	+0·71	+1·15	+2·91	+0·19	+0·72	−1·07	+0·51	−0·41	−0·18	−1·02	− 3·25	−0·67	+0·15	+1·05	+0·43	+0·51	+0·87	+3·41	− 2·29	−0·85	−2·29	−0·13	+ 0·36	−0·59
Field of Bengal current.																																
Bengal and Assam .	−0·41	−0·59	−4·40	−0·23	−0·52	−0·45	−10·37	−0·60	−0·38	−0·05	+4·02	−0·45	− 0·15	−3·27	+5·41	−0·73	+0·23	+0·71	+ 8·53	−0·72	+0·41	−0·93	−1·33	−0·50	+1·07	−4·22	− 5·78	+1·59	−1·19	+3·07	+ 0·33	−0·38
United Provinces of Agra and Oudh.	+1·08	−0·17	−0·50	−0·23	−0·87	−0·97	−11·68	+0·53	−0·21	−0·61	+4·92	−0·40	+1·61	−0·63	+7·05	+0·08	−0·28	+0·32	+ 1·83	−0·40	+1·41	−0·23	−2·61	+0·93	+2·40	−0·40	− 5·30	−0·24	−1·11	+0·27	− 3·21	−0·42
Punjab (excepting the northern and western districts).	+1·17	−0·68	−4·78	−0·37	−0·38	−1·14	− 5·69	+0·01	−0·27	−0·51	−2·61	−0·12	+1·20	−1·03	−3·72	+0·29	−1·40	−1·17	− 9·80	−0·18	−0·54	−0·30	+5·27	+0·76	+1·33	+0·02	− 5·25	−0·27	−1·78	+0·42	− 2·53	+0·63
Madras . . .	−0·35	−0·01	+5·20	−1·02	−0·37	−1·39	− 5·77	+4·12	+0·86	−0·35	+1·97	−4·60	+0·54	−0·62	+0·82	+3·72	−0·21	+1·94	− 4·01	−5·84	−0·25	+0·75	−2·00	−1·92	+2·35	+0·54	− 5·09	+2·53	+0·26	−0·49	+ 3·23	+2·67

The Table XXIX gives data of the average rainfall variation of each season in the period 1895-1902 for nine large areas.

The data are interesting as showing more fully than the previous data the tendency to deficiency of rainfall in all seasons in years of drought. This was noteworthy in 1899. They also show more fully than the previous data the abnormal features of the distribution of rainfall in different parts of India during the period.

The two following tables give the actual and percentage variations of rainfall during the period 1895-1902 at representative stations in Baluchistan, Afghanistan, Persia, Arabia and the Euphrates Valley and also at five stations in the Indian Seas and Ocean :—

TABLE XXX.

Station.	Normal rainfall.	RAINFALL VARIATION FROM NORMAL. Cold weather period, November to February.								
		1894-95.	1895-96.	1896-97.	1897-98.	1898-99.	1899-1900.	1900-01.	1901-02.	Total of eight years.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Baghdad	6·11	+1·97	+1·76	−2·76	−1·44	−3·88	−2·28	−2·49	−5·29	−14·41
Bushire	10·50	+12·22	−7·30	−4·15	−8·25	−3·04	+3·69	−3·54	−7·93	−18·29
Jask	3·11	+3·10	−1·94	−1·01	−3·00	−2·45	+3·70	+1·21	−2·44	−2·83
Quetta	5·36	−1·83	+0·60	−0·14	−2·61	−2·89	+0·43	+2·74	−5·25	−8·95
Kashgar	0·61	−0·35	−0·43	+0·01	−0·21	−0·61	+0·30	−0·49	−0·58	−2·36
Teheran	4·44	+0·95	−0·94	+1·15	−1·40	−0·90	+0·04	−0·37	+0·64	−0·83
Ispahan	1·89	+1·76	−0·83	−0·66	−0·22	−0·92	+0·89	−1·49	−0·24	−1·71
Meshed	2·65		+0·49	−0·61	−0·35	−0·10	+1·43	−1·02	+1·89	+1·73*
Kalat	3·01	−0·48		+0·07	−1·27	−0·83	+0·20	+5·83	−2·99	+0·53*
Chaman	4·23	−2·05	−1·62	+1·56	−2·63	−0·99	+2·10	+3·06	−3·90	−4·47
Kabul	3·23		−1·73	+4·59	−2·85	−3·08	−1·70	−0·22	−2·51	−7·50*
Gilgit	0·51		+0·07	+0·17	−0·22	+0·23	−0·22	+0·11	−0·39	−0·25*
Muscat	2·93	+3·12	+0·38	+1·28	−2·74	−1·99	+0·94	+0·96	−2·13	−0·18
Aden	1·21	+1·45	−0·62	−1·14	−0·81	+0·35	+0·22	−0·84	−0·80	−2·19
Perim	0·72	−0·15	−0·46	+0·01	−0·61	−0·27	+1·56	+0·04	+0·76	+0·88
Amini Devi	2·09		−1·87		−1·67	+1·58	−1·63	+1·42	+3·24	+1·07†
Minicoy	11·25	−2·68			−0·58	+12·41	−3·92	+9·47	+2·68	+17·38†
Zanzibar	16·80	+3·29	+0·10	+7·09	−11·15	−7·61	+1·29	+15·28	−2·08	+6·21
Port Blair	17·24	−14·16	−1·92	−11·15	+17·09	−14·01	−8·14	−1·24	+12·35	−21·18
Mauritius	21·50			−9·95	−5·74	−5·48	−10·27	+2·76	+9·38	−19·30

* Total of 7 years.
† Total of 6 years.

TABLE XXXI.

Station.	Percentage variation of rainfall. Cold weather period, November to February.								
	1894-95.	1895-96.	1896-97.	1897-98	1898-99.	1899-1900	1900-01.	1901-02.	Mean of eight years.
Baghdad	+ 32	+29	—45	—24	—64	37	- 41	—87	—29
Bushire	+116	—70	—39	—79	—29	+35	—34	—76	—22
Jask	+100	—62	—32	—96	—79	+119	+39	—78	—11
Quetta	— 34	+11	— 3	—49	—54	+ 8	+51	—98	—21
Kashgar	— 57	—70	+ 2	—34	—100	+49	—80	—95	—48
Teheran	+ 21	—21	+26	—32	—20	+ 1	— 8	+14	— 2
Ispahan	+ 93	—44	—35	—12	—49	+47	—79	—13	—11
Meshed		+18	—23	—13	— 4	+54	—38	+71	+ 9
Kalat	— 16		+ 2	—42	—28	+ 7	+194	—99	+ 3
Chaman	— 48	—38	+37	—62	—23	+50	+72	—92	—13
Kabul		—54	+142	—88	—95	—53	— 7	—78	—33
Gilgit		+14	+33	—43	+46	—43	+22	—76	— 7
Muscat	+106	+13	+44	—94	—68	+32	+33	—73	— 1
Aden	+120	—51	—94	—67	+29	+18	—69	—66	—23
Perim	— 21	—64	+ 1	—85	—38	+217	+ 6	+106	+15
Amini Devi		—89		—80	+76	—78	+68	+155	+ 9
Minicoy	— 24			— 5	+110	—35	+84	+24	+26
Zanzibar	+ 20	+ 1	+42	—66	—15	+ 8	+91	—12	+ 5
Port Blair	— 82	—11	—65	+99	—81	—47	— 7	+72	—15
Mauritius			—46	—27	—25	—48	+13	+44	—15

The preceding data indicate that the winter precipitation of the whole period 1895-1902 was more or less in defect over by far the greater part of the area including Afghanistan, Baluchistan, Southern Persia, Asiatic Turkey and Central Asia as represented by Kashgar. The winter rainfall of several stations in these areas for the eight years was below the normal by one to three years' supply. This was, for example, the case at Aden, Jask, Bushire, Baghdad, Quetta, Kashgar and Kabul.

As already pointed out the agricultural value of the rains depends not merely upon their amount, but upon other factors, of which the following are the most important:—

(1) Period of commencement of the rains.

(2) Period of termination of the rains.

(3) Occurrence of prolonged breaks in the rains.

(4) The character of the falls whether chiefly occasional cyclonic downpours or moderate rain at frequent intervals.

Each of these factors for the dry period 1895-1902 is considered briefly in the following discussion.

The two following tables (Tables XXXII and XXXIII) give the variation in the

dates of commencement and termination of the south-west monsoon rains in each year of the dry period 1895-1902 in fifteen large divisions, including nine in the field of the Bay current and six in that of the Bombay current:—

TABLE XXXII

	VARIATION OF THE DATE OF COMMENCEMENT OF THE MONSOON RAINS IN THE YEAR							
	1895.	1896	1897	1898	1899.	1900	1901.	1902
Field of Bengal current								
Lower Burma . .	Normal	Normal	Normal	+ 1 week	+ 2 weeks	Normal	Normal	Normal
Upper Burma . .	Do	Do.	Do	+ 1 do	+ 2 do	Do.	Do	Do.
Bengal . . .	Do	Do	Do	Normal	Normal	Do	Do	Do
Bihar . . .	Do.	Do.	Do	Do.	Do	Do	— 1 weeks	Do
Chota Nagpur .	*Do*	*Do.*	*Do*	*Do*	*Do*	*Do*	— 1 do	— 3 weeks
United Provinces East .	Do	Do	Do	+ 1 week	Do	— 3 weeks	— 3 do	— 2 do.
„ „ West.	+ 1 week	Do	+ 1 week	+ 1 do	+ 1 week	— 2 do	— 2 do.	+ 1 week
East Punjab .	+ 2 weeks	+ 1 week	+ 2 weeks	+ 2 weeks	+ 1 do	— 1 week	— 1 week	+ 1 do.
North Madras . .	Normal	— 1 do	— 1 week	Normal	— 1 do	Normal	— 1 do	— 3 weeks
Field of Bombay current								
Malwar . . .	— 1 week	— 1 do	— 1 do	— 1 week	Normal	— 1 week	Normal	— 1 week
Konkan . .	— 1 do	— 1 do	— 1 do	— 1 do	— 1 week	— 3 weeks	— 1 week	— 1 do
Central Provinces .	Normal	— 1 do	Normal	Normal	Normal	— 2 do	— 2 weeks	— 3 weeks
Central India . .	Do.	— 1 do	Do	+ 1 week	Do	— 3 do	— 3 do	— 3 do
Gujerat and Kathiwar	Do	Normal	Do	+ 1 do	Do	— 4 do	— 3 do.	— 3 do.
Rajputana . . .	Do.	— 1 week	Do	Normal	— 1 week	— 3 do	— 3 do	— 1 week

Note — + indicates that the rains began earlier than usual
— indicates that the rains began later than usual

TABLE XXXIII.

	VARIATION OF THE DATE OF TERMINATION OF THE MONSOON RAINS FROM THE NORMAL DATE IN THE YEAR							
	1895	1896.	1897	1898	1899	1900	1901.	1902.
Field of Bengal current.								
Lower Burma . .	—2 weeks	—2 weeks	+1 week	—3 weeks	Normal	—3 weeks	—2 weeks	—3 weeks
Upper Burma . .	Normal	—2 do.	—1 do	—2 do	+1 week	—2 do	—2 do	—3 do
Bengal . . .	do	—6 do	—1 do.	—2 do	—5 weeks	—2 do.	—3 do	—3 do
Bihar	+2 weeks	—4 do.	+1 do.	Normal	—3 do.	Normal	—2 do.	—1 week
Chota Nagpur . .	+2 do	—4 do	+1 do.	do.	—3 do	—1 week	—3 do.	—3 weeks
United Provinces East .	—3 do	—6 do	1 1 do	—3 weeks	—3 do.	Normal	—2 do	—2 do
„ „ West .	—2 do.	—4 do	Normal	—2 do	—1 week	do	—3 do	Normal
East Punjab . .	—1 week	—3 do.	+1 week	Normal	Normal	+2 weeks	—1 week	+1 week
North Madras . .	—3 weeks		—2 weeks	—2 weeks	—3 weeks	—1 do.	Normal	+3 weeks

Note — + indicates that the rains ended later than usual
— indicates that the rains ended earlier than usual

TABLE XXXIII—*concluded.*

	VARIATION OF THE DATE OF TERMINATION OF THE MONSOON RAINS FROM THE NORMAL DATE IN THE YEAR.							
	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
Field of Bombay current.								
Malabar . . .	—1 week	—3 weeks	—1 week	Normal	—2 weeks	—2 weeks	—2 weeks	—1 week
Konkan . . .	+2 weeks	—7 do.	—1 do.	+1 week	—3 do.	—3 do.	—5 do.	—4 weeks
Central Provinces .	—3 do.	—6 do.	—3 weeks	—2 weeks	—4 do.	—2 do.	—3 do.	—3 do
Central India . .	—1 week	—5 do.	Normal	—2 do.	—2 do	Normal	—1 week	—1 week
Gujarat and Kathiawar	+4 weeks	—5 do.	+2 weeks	—1 week	—8 do.	Do.	—1 do.	Normal
Rajputana . . .	Normal	—5 do.	+1 week	Normal	—8 do.	+1 week	—2 weeks	Do.

Note — + indicates that the rains ended later than usual.
— indicates that the rains ended earlier than usual.

The chief inferences from the data of Tables XXXII and XXXIII are:—

(1) The date of establishment of the monsoon rains differed little from the normal in the field of the Bengal current, except in the United Provinces and the East Punjab in the years 1900 and 1901, when the delay ranged from three weeks in the eastern districts of the United Provinces to one week in the Punjab. It is noteworthy that there was no prolonged delay in either of the drought years 1896 and 1899.

(2) The commencement of the monsoon rains in the field of the Bombay current in the years from 1895 to 1899, although slightly delayed in the coast districts, occurred on the whole about the normal date in the interior, including North Bombay, the Central Provinces, Central India and Rajputana. These rains were, on the other hand, more or less considerably delayed in the years 1900, 1901 and 1902 by amounts averaging about two weeks in the coast districts and three to four weeks in the interior districts in each of these years. The delay was on the whole most marked in the year 1900.

(3) The termination of the monsoon rains varied far more largely from the normal than did the commencement. The rains ceased earlier than usual in 1896 in the field of the Bay current by amounts ranging from two to five weeks in Burma, the United Provinces, Chota Nagpur and Bihar, and by six weeks in Bengal. They terminated from three to seven weeks earlier than usual in the field of the Bombay current. The crops hence dried off and failed almost completely, more especially over the greater part of the Gangetic Plain and in the Central Provinces.

The variations were slight in 1897. In 1898 the rains ended from two to three weeks earlier than usual in Burma, Bengal and the United Provinces.

In 1899 the rains terminated disastrously early over the greater part of the field of the Bombay current, more especially in Rajputana, Gujarat and Kathiawar. They ceased more or less before the normal date in the field of the Bombay current in 1900, and also over nearly the whole of India in 1901.

and 1902. The acceleration in the termination of the rains averaged about two weeks in 1901 over nearly the whole of India and also about the same in 1902, but the range of variation was greater than in 1901.

The following table gives data showing the variation in the length of the monsoon rains in different parts of India during each of the years of the dry period :—

TABLE XXXIV.

	Normal length of monsoon period.	Variation in the length of the monsoon period in							
		1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
Field of Bengal current.	Weeks.	Weeks.	Weeks.	Weeks.	Weeks.	Weeks.	Weeks.	Weeks.	Weeks.
Lower Burma	22	−2	−2	+1	−2	+2	−3	−2	−3
Upper Burma	21	0	−2	−1	−1	+3	−2	−2	−3
Bengal	20	0	−6	−2	−2	−5	−2	−3	−3
Bihar	17½	+2	−4	+1	0	−3	0	−5	−1
Chota Nagpur	17½	+2	−4	+1	0	−3	−1	−6	−6
United Provinces, East	17	−3	−6	+1	−2	−3	−3	−5	−4
„ „ West	13½	−1	−4	+1	−1	0	−2	−5	+1
East Punjab	11	+1	−2	+3	+2	+1	+1	−2	+2
North Madras	25	−3		−3	−2	−4	−3	−1	0
Field of Bombay current.									
Malabar	24	−2	−4	−2	−1	−2	−3	−2	−2
Konkan	20	+1	−8	−2	0	−4	−6	−6	−5
Central Provinces	18	−3	−7	−3	−2	−4	−4	−5	−6
Central India	15½	−1	−6	0	−1	−2	−3	−4	−4
Gujarat and Kathiawar	14½	+4	−5	+2	0	−3	−4	−4	−3
Rajputana	14	0	−6	+1	0	−9	−2	−5	−1

The data of the preceding table are very interesting as they show that a marked feature of the dry period was the late appearance and the early withdrawal (more especially the latter) of the monsoon rains and hence the abbreviation of the period of prevalence of the rainfall. The last feature as shown by the data of Table XXXIV was most pronounced in the interior districts of both fields, more especially the Gangetic Plain, Rajputana, Gujarat and Kathiawar, Central India and the Central Provinces.

The following are the more important general conclusions :—

(1) The abbreviation of the monsoon was most marked in the interior districts.

(2) The abbreviation of the monsoon was very marked in the years 1896, 1899, 1900, 1901 and 1902, and was more pronounced in the area of the Bombay current than in the field of the Bengal current.

(3) Over part of the area including the Central Provinces, Central India and Rajputana this feature of the shortness of the period of the monsoon rains was remarkably persistent during the period.

(4) In the years which departed least from the normal, the coast districts, more especially the Konkan, received rainfall normal in amount and character and the deficiency was only in the interior, the region of greatest deficiency varying to some extent from year to year.

(5) The year of greatest deficiency was characterized by scanty rain over the whole field of the Bombay current, the amount of percentage deficiency increasing from the coast districts to the interior.

(6) The years of greatest deficiency were also years of shortest monsoon rainfall period. This was general throughout but very marked in 1896 and 1899 and most marked in 1899 in the area of greatest deficiency including North Bombay, Rajputana and Central India West, and in 1896 in the Konkan, Berar and the Central Provinces.

The following table gives the number of days on which falls exceeding 3 inches were received at certain representative stations during the period and the average number of such falls per year during the period —

TABLE XXXV.

Province	Representative stations	Number of occasions on which rainfall in 24 hours exceeded 3 inches during the wet season of									
		1895	1896	1897	1898	1899	1900	1901	1902	Total of period	Average annual of period
Bombay and Malabar coast districts	Bombay	6	8	7	7	2	6	6	5	47	5·9
	Karwar	9	8	10	7	1	10	10	15	70	8·7
	Matheran	16	31	25	23	7	25	24	16	167	20·9
	Poona	1	2	1	0	0	0	0	1	5	0·6
Central Provinces	Nagpur	4	5	1	1	0	3	1	1	16	2·0
	Saugor	2	2	1	3	1	1	3	2	15	1·9
	Sambalpur	3	10	4	2	3	5	2	3	32	4·0
North Bombay	Ahmedabad	1	2	0	1	0	0	0	2	6	0·8
	Rajkot	1	3	2	1	0	2	0	2	11	1·4
	Bhuj	1	0	0	0	0	1	0	0	2	0·2
	Kurrachee	0	2	1	0	0	0	0	2	5	0·6
Rajputana and Central India	Jaipur	0	0	0	1	1	1	1	0	4	0·5
	Udaipur	0	2	0	0	0	3	0	0	5	0·6
	Ajmer	1	2	0	0	0	1	0	1	5	0·6
North and West Punjab	Dera Ismail Khan	0	0	0	0	0	0	1	0	1	0·1
	Moultan	0	0	1	0	0	0	0	0	1	0·1
Bengal and Assam	False Point	4	5	4		1	5	1	2	27	3·4
	Calcutta	0	0	1	2	5	4	4	1	17	2·1
	Bordwan	1	1	2	6	3	1	2	0	16	2·0
	Patna	2	2	2	2	2	4	1	2	17	2·1

TABLE XXXV—*concluded.*

Province.	Representative Stations.	Number of occasions on which rainfall in 24 hours exceeded 3 inches during the wet season of									
		1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	Total of period.	Average annual of period.
Bengal and Assam	Hazaribagh	1	6	3	6	0	3	1	0	20	2·5
	Cherra Poonjee	28	25	45	39	56	43	33	40	309	38·6
	Dhubri	10	4	2	5	7	1	2	9	40	5·0
United Provinces of Agra and Oudh.	Allahabad	1	0	1	3	0	1	2	1	9	1·1
	Agra	0	0	2	0	0	0	0	0	2	0·2
	Meerut	4	0	2	0	0	2	2	1	11	1·4
Punjab (excepting northern and western districts).	Lahore	0	0	0	0	0	0	1	0	1	0·1
	Rawalpindi	2	0	0	1	0	0	0	0	3	0·4
	Umballa	4	2	3	0	0	2	1	1	13	1·6

A comparison of the data of the last column with those of the corresponding column for the period, 1892 to 1894, Table XX, shows that over the greater part of the country the mean annual number of heavy falls in 24 hours differed very little in the two periods. The chief features disclosed by the preceding table are the scantiness of such falls over the greater part of the Gangetic Plain in 1896, and over nearly the whole of India in 1899, more especially in the coast and hill districts of the Bombay Presidency. In fact an important feature of the 1899 drought was the remarkable absence of heavy downpours in the field of the Bombay current.

The following table gives data showing the average fall per rainy day in ten large divisions in each monsoon of the period 1895 to 1902:—

TABLE XXXVI.

Field.	Area.	Mean rainfall per rainy day.	Ratio of actual rainfall of wet season to number of rainy days.							
			1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
		Inch.								
Bombay Current.	Bombay and Malabar Coast Districts	0·89	0·8	1·0	0·9	0·8	0·7	0·9	0·8	0·9
	Central Provinces and Berar	0·91	0·8	1·0	0·8	0·8	0·7	0·9	0·9	0·8
	North Bombay	0·94	0·8	0·9	0·8	0·9	0·5	0·9	0·7	1·0
	Rajputana and Central India	0·93	0·7	0·8	0·8	0·8	0·8	0·8	0·8	0·8
	North and West Punjab	0·81	0·8	0·6	0·7	0·8	0·6	0·6	0·7	0·6
Bengal Current.	Burma	?	0·9	1·1	1·0	1·0	0·9	1·1	1·0	1·1
	Bengal and Assam	0·89	0·9	0·9	0·9	1·0	1·0	1·0	0·9	0·9
	United Provinces of Agra and Oudh	0·92	0·9	0·8	1·0	1·0	1·0	0·8	0·9	0·9
	Punjab (excepting the northern and western districts).	0·93	0·7	0·7	0·8	0·8	0·6	1·0	0·8	0·8
	Madras	0·75	0·8	0·7	0·7	0·8	0·7	0·7	0·7	0·8

The preceding data indicate that during the whole period there was a marked tendency for a smaller amount to fall per rainy day in the interior. This was conspicuously the case in the Punjab and Rajputana. Thus the average fall per rainy day for the period in the West and North Punjab was only 0·68 inch as compared with the normal 0·81 inch, and in Rajputana and Central India 0·8 inch as compared with 0·93 inch.

The drought of 1896 reduced the fall per rainy day to a moderate extent in the Punjab, Rajputana and United Provinces. That of 1899 produced a much larger effect and the rainfall per rainy day was 50 per cent. below the normal in North Bombay and 25 per cent. in the Central Provinces and Punjab.

The following gives a statement of the more important breaks of the rains in each monsoon season of the period. It will be seen that the breaks were prolonged and serious in the years 1898, 1899 and 1902:—

TABLE XXXVII.

Year.	Month	Period of break.	Area affected.	Character of break.
1895	July	2nd to 11th	North-Western and Central India	Almost complete.
"	"	12th to 20th	Ditto ditto	Ditto.
"	August	11th to 24th or 25th.	Commenced in Rajputana on the 11th, extended to the Punjab, Central India and the Central and United Provinces on the 17th.	Complete.
1896	July	23rd to 30th	Gangetic Plain	Almost complete.
1897	June—July	24th June to 7th July.	Began in North-West and Central India and the Deccan on the 24th June and extended to Bengal on the 29th.	Complete.
"	September	16th to 24th	North-Western and Central India	Almost complete.
1898	June	18th to 28th	Commenced in the Punjab, Rajputana and Central India on the 18th and extended to Berar, the Central Provinces and Deccan on the 21st and to Bengal on the 25th.	Complete.
"	August	5th to 20th	The Punjab, Rajputana and the Deccan	Almost complete.
1899			More or less complete drought prevailed over the greater part of the area dependent on the Bombay current from July to September.	
1900	July	18th to 26th	North-Western India	Almost complete.
"	August	23rd to 30th	Ditto and Central India	Partial.
1901	September	10th to 21st or 22nd.	Bengal, the United Provinces, Central Provinces and Central India.	Almost complete.
1902	June	17th to 29th	Over nearly the whole of the interior of India.	Ditto.
"	August	3rd to 18th or 19th.	Practically the whole of North-Western and Central India and the Deccan.	Ditto.

RAINFALL IN CERTAIN REGIONS OUTSIDE THE INDIAN AREA.

Rainfall in Australia, South Africa and Central Asia.—The following gives a summary of the rainfall data for representative stations in Australia, South Africa and Central Asia, for which data are available in the Indian Meteorological Office :—

TABLE XXXVIII.

AREA.	STATION.	ACTUAL VARIATION OF RAINFALL OF PERIOD.	
		1892-4	1895-1901.
		Inches.	Inches.
AUSTRALIA	Perth	− 4·05	− 2·51
	Adelaide	+ 2·63	−10·49†
	Melbourne	− 2·30	−10·86
	Sydney	+ 8·38	−32·21*
	Brisbane South	+18·22	−18·22‡
SOUTH AFRICA	Cape Town (Royal Observatory)	+ 9·43	−12·35§
	Queenstown	+11·39	− 11·47§
JAVA	Batavia	+19·22	+10·89
CENTRAL ASIA	Samarkhand	− 0·82	+ 0·82§
	Tashkent	− 2·90	+ 2·86§
	Astrakhan	− 4·07	+ 4·09§
	Baku	+ 0·11	− 0·14†
	Tiflis	− 6·76	+ 6·80§

* Total of three years. † Total of five years. ‡ Total of two years. § Total of six years.

The data available in the Indian Meteorological Office for these areas are very limited in amount, and are also in several cases incomplete for the period.

They establish that the general contrast between the precipitation of the two periods 1892-94 and 1895-1901 which obtained in India extended to Australia and South Africa. In the whole area (taking into consideration the corresponding data given in pages 214, 229 and 230) the precipitation for the period 1892-94 was more or less in excess over the very large area including Persia, Baluchistan, Afghanistan, India, Tibet, South and East Africa, Mauritius, Australia, and the Malay Peninsula (as represented by Singapore) and was in more or less general defect over the same areas in the period 1895-1901. In other words the area including these countries which are directly and mainly dependent upon the Indian Ocean for their rainfall was characterized by the same general features, *viz.*, increased rainfall in the years 1892—94 and diminished precipitation in the period 1895-1901. The data for the stations in Russia, Turkistan and Central Asia on the other hand clearly indicate that that area was marked by variations opposite in character to those of the Indo-Australian and East African region. Hence, so far as can be judged from the imperfect data available, the Central Asia winter anticyclone area defined the northern limits of the area of similar rainfall conditions in the period 1892-1902 under discussion.

Rainfall in Abyssinia as indicated by the Nile Floods.—The rainfall in Abyssinia and the Central Africa Lake region is indicated more or less clearly by the height of the Nile floods.

The character of the Nile floods during the period 1892-94 is given in the following table:—

TABLE XXXIX

Year.	Character of the Nile Flood.	Mean discharge, Assuan, September.
1892	Late but very high flood	11,800 cubic metres per second.
1893	Normal flood	8,400 do.
1894	High flood	10,900 do.

The normal or average discharge in September when the volume of water passing Assuan is greatest is 9,050 cubic metres per second. The preceding data thus establish that the Nile floods were on the whole largely above the average height during this period, and hence that the rainfall in the Abyssinian Plateau and, perhaps (as indicated by the discharge in April, May and June of these years, especially 1893) the rainfall in the Equatorial lake regions also was considerably above the mean. The following gives data for these months:—

TABLE XL.

Year.	Mean discharge, Assuan, in cubic metres per second in		
	April	May.	June
1892	380	260	290
1893	1,530	650	610
1894	490	450	530
Mean of 30 years	570	450	570

The two following tables give corresponding data for the dry period. Table XLI furnishes information of the general character of the Nile floods, and also the mean discharge as measured at Assuan:—

TABLE XLI.

Year.	Character of the Nile Flood	Mean discharge, Assuan, in September.
1895	Probably normal	10,050 cubic metres per second.
1896	Normal	10,300 " "
1897	Below	8,600 " "
1898	Probably normal	10,050 " "
1899	Much below	6,150 " "
1900	Below	7,800 " "
1901	Below	8,400 " "
1902	Much below	6,450 " "

The data of the last column show that the mean discharge was below the normal (9,050-cubic metres) in five out of the eight years, and that it was in very large defect in 1899 and 1902. In 1899, the Arabian Sea monsoon was feeble throughout the whole period, and in 1902 was very weak during the first half of the monsoon period. The data hence indicate that during the greater part of the period the rainfall was more or less considerably in defect in the Abyssinian catchment area and also that there was a close parallelism between the precipitation in that area and in the field of the Arabian Sea current in India.

The following table gives the mean discharge at Assuan in April, May and June of the same years:—

TABLE XLII.

Year.	Mean discharge, Assuan, cubic metres per second in		
	April.	May.	June.
1895	930	880	780
1896	830	690	690
1897	730	690	690
1898	410	380	350
1899	930	610	570
1900	170	170	290
1901	350	320	380
1902	320	290	320
Mean of 30 years	570	450	570

The data indicate that the discharge was greater than usual in these months of the years 1895, 1896, 1897 and 1899, and hence that during these years the rainfall in the Equatorial lake districts was perhaps in excess.

The discharge was considerably less than usual in the years 1898, 1900, 1901 and 1902. The data for the year 1900 are unique, and the smallness of the discharge from the Equatorial lakes in that period is probably an additional result of very scanty rainfall as indicated by the September discharge at Assuan, and also by general information over the whole of East Africa as well as in Abyssinia during the south-west monsoon of 1899.

General character of the weather and rainfall in South Africa during the period 1896-1902 based chiefly on information supplied by Mr. D. Hutchins, Conservator of Forests.

1895-6.—"The absence of the south-east trades in the Cape throughout the summer of 1895-6 (*i.e.*, November 1895 to March or April 1896) brought drought, scarcity and locusts to the bulk of the continent where the usual summer rains failed."

1896-7.—"The strength of the south-east trades was in excess of the normal up to the first week of January. Thence to the end of April the trades were below normal but stronger than in the same period last year. Heavy rain fell in the first week of May along the south-east coast, causing disastrous floods at Port Elizabeth. The south-east trades rainfall was abundant up to Christmas and from thence to April irregular; deficient over considerable areas and in excess in others. There was continued heavy rain during January in the eastern districts of the Orange Free State. The south-east rainy season lasted longer than usual, but terminated about the middle of July."

1897-8.—"From July 1897 a late and unusually prolonged winter obtained with curious wintry breaks during the following summer. Snow fell on the mountains at mid-summer (December). The spring (September to November) was unusually cool with early heavy rain. The range of mountains nearest the sea was in March and April 1898 snow-capped and a few miles further inland at Dra Reustein the mountains were covered with snow down to about a thousand feet above sea-level South Africa received on the whole favourable rain during the summer."

1898-9.—"Weather was phenomenally cold in Southern Africa in July 1898, 'bitterly cold weather' being reported from all parts of the country. The summer rainfall was normal or in slight defect in the early part of the season, but in February 1899 heavy general rain commenced and the rainfall of that month was heavier and more general than for some years past, and terminated the drought which had prevailed more or less over the whole area of south-east trades rainfall in South Africa for several years previously. At the end of February followed weather such as has not occurred for at least a quarter of a century. Heavy rain continued to fall at intervals during the remainder of summer and autumn and apparently set up conditions which brought thunderstorms and winter rains to immense tracts, where for many years past only summer rains have prevailed. Normally the Karoo, the Free State and the Transvaal are watered almost exclusively by summer rains. This year winter rains have prevailed right through the Karoo, across the Orange River and far into the Kalaharu Desert." In fact abnormally heavy and untimely rain fell from May to August 1899, in which the rains failed so conspicuously in India and when clear dry cool weather as a rule prevails continuously in South Africa.

1899-1900.—"The weather from November to April resembled the summer of 1895-6, but the failure of the south-east trades was less marked. In the Cape Peninsula there were light unseasonable rains during the whole summer, and to it is ascribed a somewhat unhealthy summer, and an unusual plague of mosquitoes. The south-east winds were much below the average during the greater part of the season, more especially in February, when they failed almost completely.

"At Swellendam, and Knysna and along the southern coast into the Transkei there was intense drought up to the middle of January. At Swellendam and Knysna fair rains then commenced and prevailed for some time. Further east towards the Transkei in the region of normally strong south-east trades the usually heavy summer rains were markedly absent, and it was not until the middle of March that good rain fell. The drought was intense along the Natal coast, but fair rain prevailed during the latter part of summer, over the coast mountain ranges. The drought was most severe in November. The total deficiency at Durban during the five months, November to March, was 10 inches, or 41 per cent. of the normal *viz.*, 24·15 inches.

"In the Transvaal the rains were very light and in Rhodesia they were scanty as compared with the preceding year."

1900-1.—"The weather of South Africa in this period presented many abnormal features. During October the weather was nearly normal, though drought at the eastern stations indicated a slightly delayed arrival of the south-east trade. During November heavy south-easters began to prevail, and gave rainfall chiefly to the western stations of the colony. During December the south-easters blew with terrific force in the Cape Peninsula and at the western stations, and gave excessive rainfall in the south-west of Cape Colony and extending right across the sub-continent to Salisbury. On the shores of the False Bay the south-east wind was stronger than at any time since 1895.

"Early in January, however, there came a change ushering in the peculiar feature of the season. During that month three depressions, altogether abnormal for the time of the year in their depth and strength, passed across the colony from east to west. These depressions were deeper and stronger than occur even in winter. (The summer depressions in South Africa are usually shallow and weak). The first of these deep depressions passed during the last week in December. Abnormally heavy rain, altogether unprecedented for the time of the year, fell. For example, five inches of rain fell in 24 hours at Kenilworth near Cape Town. This is the largest fall on record at that station. The rain was equally heavy in proportion all over the south-west of Cape Colony. This was followed by the advance of another depression nearly as remarkable. Rain again fell in torrents in Cape Town and the suburbs. This abnormal weather continued during January. Remarkably low temperatures prevailed during January and February as the result of the abnormal storms and rain. During January the average rainfall at seven selected average stations in the Cape Peninsula was sixteen times the normal. This heavy rain extended inland over the south-west of the continent. It flooded rivers and ruined the vine crop. At Ceres there fell seventeen times the average; at Drakenstein near Paarl, twelve times the average. The south-east of the colony, on the other hand, showed a deficient rainfall, though not to a great extent.

"From February to April, the weather was normal with slightly stronger south-east wind than usual, bringing good rains to all that part of the continent watered by the south-east trades. The weather from the middle of April to the end of July was characterized by a somewhat early decline of the south-east trades and by the early setting in of winter, at least two weeks earlier than usual with the appearance of a deep depression of the winter type and heavy rain on the 12th.

"The rainfall during the period was largely in defect in the western, southern and eastern districts of South Africa, but in excess in the northern districts including the Karoo and Rhodesia and perhaps the Transvaal."

1901-2.—"The South-East Trade winds were generally steady, but not strong from November to March. The rainfall of the period at the Cape was seventeen per cent. in excess, at the western stations of the Colony nineteen per cent. in defect, in Natal seventeen per cent. in defect, in Orangia fifteen per cent. in defect, and in the Transvaal and Rhodesia in slight defect and in the Eastern Transkei abundant early in the season but deficient later. In April the weather was similar, but with weaker south-east trades. The rainfall of the month was in considerable to large defect everywhere. The rainfall was in defect in May to an equally large extent."

The latest information concerning South Africa (received from Mr. Hutchins, December 1903,) is as follows:—

"In the Karoo the present drought is considered to be the worst during the past half century. At Hanovar (Upper Karoo), during nearly a year there has only fallen three quarters of an inch of rain, the normal yearly fall being 15 inches. The drought has lasted on and off since 1896 and during the worst years cattle and sheep have perished by millions. In British Central Africa the drought has lasted since 1898. It is reported that the Shire Lake is now nearly dry. Last summer's crops in the Transvaal, sorely needed after the war, were a complete failure. In Natal, Rhodesia and the country to the north there was in many places famine. The local conditions and indications are fortunately favourable for an early termination of the drought."

Period and intensity of drought in Australia, as indicated by information extracted from newspapers.—According to statements in newspapers the period 1895–1902 was characterized by as great a deficiency of rainfall in Australia generally as in India and the drought apparently intensified throughout the period and was most severe in 1901-2. The following extracts from Australian newspapers show the intensity of the drought:—

1902.—"New South Wales is now experiencing the seventh year of almost continuous drought. It is estimated that the colony has lost in these seven years of drought no fewer than fifty million sheep, worth 12½ millions sterling, while the loss in other ways is incalculable. In the New South Wales Parliament, the leader of the country party declared in December 1902 that since Australia was populated by Europeans there had been no such serious drought as the present"

"The effects are worst in the inland districts of New South Wales and Queensland. It is estimated that the total wheat shortage in Australia is 13,000,000 bushels, of which New South Wales has lost 6,500,000. South Australia is the only state without serious shortage. Evidence of distress is accumulating. Families in parts of Queensland are living on bran and treacle, bought originally as a makeshift food for sheep. Necessaries are increasingly scarce in the bush, where meat and vegetables have to be obtained from the coast."

"It is officially calculated that there were at the end of 1902 only 20,000,000 sheep left in New South Wales, compared with 60,000,000 five years ago. Squatters have dismissed the bulk of their employés, retaining only a few hands necessary to burn the carcases of sheep and cattle where they have dropped dead in the paddocks, which in many cases present a spectacle of ashheaps, the result of burning the dead animals."

"In 1901 the Coonamble district grazed 1,257,182 sheep, 8,244 cattle, and 4,871 horses. Now the cattle and horses together number less than one thousand, and the sheep—all poor, emaciated animals—less than half a million. The reductions, however, are due partly to removals to better country. The Bourke district in 1891 possessed 3,328,810 sheep, giving 88,000 bales of wool. In 1901 the sheep numbered 490,000, and in 1902 only 300,000, returning 8,000 bales, hardly covering the cost of keeping the stock alive. There was also a corresponding decrease in cattle."

"The Bishop of Riverina compares his diocese to a great Sahara. The country, he says, is grassless. A few sheep are existing somehow where there are patches of saltbush, but even the saltbush is dying. The rivers are dry, and the opal fields of white cliffs near the river port of *Wilcannia* are dependent on water carted from the Government tanks nine

miles distant. The Bishop adds that there are a million less sheep in the neighbourhood than at the beginning of the year owing to deaths and removals."

The extracts show that the drought was most severe in the interior districts of the continent, as was also the case in India, and that its most serious economic effect was the almost entire loss of the cattle and sheep. In this respect also the parallelism with India is complete.

In the appendix are given extracts from the Famine Reports compiled by the two Commissions appointed by the Government of India to investigate the phenomena and economic effects of the droughts of 1896 and 1899 in India.

Abnormal features of temperature, humidity, cloud pressure and solar radiation in India during the period 1892-1902.

The following gives a summary of the chief features of the annual variation of the elements of meteorological observations, including temperature, humidity, cloud, pressure, solar radiation and ground surface temperature during the period 1892-1902.

Temperature.—The temperature data for the period are of considerable interest.

The following gives a brief summary of the data followed by a discussion of the more important features.

In Table XLIII below are given the actual variations of the mean monthly temperature, month by month, for the period of the whole of India from the normal (calculated as the arithmetical means of the corresponding data of about 250 observatories). In Table XLIV the monthly variations have been smoothed by the application to successive months of the formula :—

$$\beta = \frac{a+b+c}{3}$$

where a, b and c are three consecutive values and β is the smoothed value of the middle term (b): the annual variations have here been smoothed by applying to successive years the formula

$$\beta = \frac{a+2b+c}{4}.$$

Table XLIII.

Year.	Actual variation of mean temperature in the Indian area.												
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1890	+0·9	+1·6	+0·2	+0·4	+0·6	−0·5	−1·1	−1·0	−0·4	−0·2	−0·1	+1·2	+0·1
1891	+0·2	−1·4	−3·1	−0·2	−0·2	+2·0	+1·2	−0·2	0	−0·4	+0·9	+0·8	0
1892	+2·0	+2·0	+1·8	+3·2	+1·8	−0·2	+0·3	−0·6	−0·5	−0·1	−1·1	−0·7	+0·7
1893	−2·1	−4·1	−3·8	−0·5	−1·3	−2·0	−0·9	0	−0·9	−0·4	+0·1	0	−1·3
1894	+0·2	+1·9	−0·5	0	+1·5	−0·6	−0·7	−0·5	−0·1	+0·4	−0·5	+0·2	+0·1
1895	0	+0·6	−0·2	−1·1	+2·4	−0·2	+0·3	−0·1	+0·7	−0·2	+2·1	−0·1	+0·4
1896	+0·6	+1·6	+1·6	+2·2	+2·3	+0·1	+1·1	+0·2	+1·2	+1·8	+2·2	+0·7	+1·3
1897	+1·6	+2·0	0	+0·3	+1·7	+1·4	+1·3	+0·5	+0·5	+0·7	+0·7	−0·1	+0·9
1898	+0·8	−0·1	+0·5	+2·5	+0·0	+0·8	−0·1	+0·3	−0·2	+0·9	+0·7	+1·1	+0·7
1899	−2·2	+0·9	+1·6	−1·1	+0·8	+0·1	+0·9	+2·0	+1·6	+2·0	+1·2	+1·5	+0·8
1900	+1·2	+2·1	+2·4	0	+0·8	+1·9	+1·3	+0·8	+0·1	0	+1·7	+1·7	+1·2
1901	−0·3	−0·5	+0·3	−0·1	+0·3	+1·7	+0·9	+0·4	+0·9	+2·1	+1·3	+0·6	+0·6
1902	+2·0	+2·1	+2·3	+0·5	+1·2	+1·0	+0·7	+1·5	+0·4	+0·5	+0·3	+0·2	+1·1

TABLE XLIV.

YEAR.	SMOOTHED VARIATION OF MEAN TEMPERATURE IN THE INDIAN AREA.												
	January.	February.	March.	April.	May.	Jun	July.	August.	September.	October.	November.	December.	YEAR.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1890	+1·2	+0·9	+0·7	+0·4	+0·2	−0·3	−0·9	−0·8	−0·5	−0·2	+0·3	+0·4	+0·3
1891	0	1·4	−1·6	−1·2	+0·5	+1·0	+1·0	+0·3	−0·2	+0·2	+0·4	+1·2	+0·2
1892	+1·6	+1·9	+2·3	+2·3	+1·6	+0·6	−0·2	−0·3	−0·4	−0·6	−0·6	−1·3	0
1893	−2·3	−3·3	−2·8	−1·9	−1·3	−1·4	−1·0	−0·6	−0·4	−0·4	−0·1	+0·1	−0·5
1894	+0·7	+0·5	+0·5	+0·3	+0·3	+0·1	−0·6	−0·4	−0·1	−0·1	0	−0·2	−0·2
1895	+0·3	+0·1	−0·2	+0·4	+0·4	+0·8	0	+0·3	+0·1	+0·9	+0·6	+0·9	+0·6
1896	+0·7	+1·3	+1·8	+2·0	+1·5	+1·2	+0·5	+0·8	+1·2	+1·7	+1·6	+1·5	+1·0
1897	+1·4	+1·2	+0·8	+0·7	+1·1	+1·5	+1·1	+0·8	+0·6	+0·6	+0·4	+0·5	+1·0
1898	+0·2	+0·4	+1·0	+1·2	+1·3	+0·4	+0·3	0	+0·3	+0·5	+0·9	−0·1	+0·8
1899	−0·1	+0·1	+0·5	+0·4	−0·1	+0·6	+1·0	+1·5	+1·9	+1·6	+1·6	+1·3	+0·9
1900	+1·6	+1·9	+1·5	+1·1	+0·9	+1·3	+1·3	+0·7	+0·3	+0·6	+1·1	+1·6	+1·0
1901	+0·3	−0·2	−0·1	+0·2	+0·6	+1·0	+1·0	+0·7	+1·1	+1·4	+1·3	+1·3	+0·9
1902	+1·6	+2·1	+1·6	+1·3	+0·9	+1·0	+1·1	+0·9	+0·8	+0·4	+0·3	+0·3	+0·8

The following gives the number of times in each month, the actual variation was 2°·0 or more:—

January	4 times.	June	2 times.
February	5 „	August	1 time.
March	4 „	October	2 times.
April	3 „	November	2 „
May	2 „		

The largest variations of temperature during the period occurred from January to April, that is, in the cold season and the early part of the hot weather. This is in accordance with the experience of the past thirty years.

The largest actual negative variation was 4°·1 in February 1893, and the largest positive variation 3°·2 in April 1892. The largest annual variations were −1°·3 in 1893 and +1°·3 in 1896.

Figure 5, Plate I, represents the march of the smoothed annual variation of temperature from the normal in India from 1890 to 1902. The curve indicates that temperature on the mean of the year was approximately normal in India from 1890 to 1892 and fell below to a slight extent in 1893 and 1894, the minimum occurring in 1893. It increased above the normal in 1895 and was above it by nearly equal amounts annually from that date to 1902.

The curve shows that the smoothed annual temperature of India had a maximum value in 1896, a very feeble minimum in 1898 and a maximum, probably in 1902.

The monthly variation data in Tables XLIII and XLIV indicate that temperature was below the normal during nearly the whole period from June 1892 to the end of 1894 or the period of increased rainfall. The deficiency was marked and persistent throughout the year 1893, *i. e.* of greatest excess of rainfall.

The mean annual temperature of India during the dry period 1895 to 1902 was, on the other hand, persistently above the normal. The actual excess was greatest in the *year 1896 and was also large (over 1°) in 1900 and 1902.*

The most important feature of the dry period from 1895 to 1902 undoubtedly was that temperature was in excess in all months of each of the years of the period almost without exception. The excess was hence not seasonal but was general and common to the whole period.

This peculiarity is clearly shown by the variations for each season of the period. Table XLV gives the actual variations from the normal for each season of the period on the mean of the whole of India, and Table XLVA gives the smoothed means obtained by the application of the formula $\beta=\frac{a+2b+c}{4}$ to the corresponding seasons of successive years

TABLE XLV

Year.	Actual variation from normal of mean temperature.						
	Whole India				Year		
	Cold weather period January and February	Hot weather period March to May	South west monsoon period June to October.	Retreating south west monsoon period, November and December.	Extra Tropical India.	Tropical India.	Whole India
	°	°	°	°	°	°	°
1890	+1·3	+0·4	−0·6	+0·6	+0·4	−0·1	+0·1
1891	−0·6	−1·2	+0·5	+0·9	−0·2	+0·3	0
1892	+2·0	+2·3	−0·2	−0·9	+1·0	+0·1	+0·7
1893	−3·1	−1·9	−0·8	+0·1	−1·6	−0·9	−1·3
1894	+1·1	+0·3	−0·3	−0·2	0	+0·3	+0·1
1895	+0·3	+0·4	+0·1	+1·0	+0·4	+0·3	+0·4
1896	+1·1	+2·0	+0·9	+1·5	+1·3	+1·3	+1·3
1897	+1·8	+0·7	+0·9	+0·3	+0·6	+1·2	+0·9
1898	+0·4	+1·2	+0·3	+0·9	+0·8	+0·5	+0·7
1899	−0·7	+0·4	+1·3	+1·4	+0·8	+0·7	+0·8
1900	+1·7	+1·1	+0·8	+1·7	+0·7	+1·7	+1·2
1901	−0·4	+0·2	+1·2	+1·0	+0·5	+0·8	+0·6
1902	+2·1	+1·3	+0·8	+0·3	+1·0	+1·1	+1·1

TABLE XLVA.

Year.	SMOOTHED VARIATION FROM NORMAL OF MEAN TEMPERATURE.						
	Whole India.				Year.		
	Cold weather period, January and February.	Hot weather period, March to May.	South-west monsoon period, June to October	Retreating south-west monsoon period, November and December.	Extra Tropical India.	Tropical India.	Whole India.
	°	°	°	°	°	°	°
1890 . . .	+0·9	+0·3	−0·1	+0·7	+0·4	+0·1	+0·3
1891 . . .	+0·5	+0·1	+0·1	+0·4	+0·3	+0·2	+0·2
1892 . . .	+0·1	+0·4	−0·2	−0·2	+0·1	−0·1	0
1893 . . .	−0·8	−0·3	−0·5	−0·2	−0·6	−0·4	−0·5
18 . . .	−0·2	−0·2	−0·3	+0·2	−0·3	0	−0·2
1895 . . .	+0·7	+0·8	+0·2	+0·8	+0·5	+0·6	+0·6
1895 . . .	+1·1	+1·3	+0·7	+1·1	+0·9	+1·0	+1·0
1897 . . .	+1·3	+1·2	+0·8	+0·8	+0·8	+1·1	+1·0
1898 . . .	+0·5	+0·9	+0·7	+0·9	+0·8	+0·7	+0·8
1899 . . .	+0·2	+0·8	+0·9	+1·4	+0·8	+0·9	+0·9
1900 . . .	+0·6	+0·7	+1·0	+1·5	+0·7	+1·2	+1·0
1901 . . .	+0·8	+0·7	+1·0	+1·0	+0·7	+1·1	+0·9
1902 . . .	+1·0	+0·6	+0·9	+0·2	+0·7	+0·8	+0·8

The preceding data show that the actual temperature of the Indian area was below the normal in seven out of the twelve seasons of the period 1892-1894, and was in excess in all seasons except two (the cold weather periods of 1899 and 1901) during the whole period 1895-1902. The variations were hence (as might be expected) more marked and persistent in the dry than the wet period, the usual rule in India.

The seasonal data of the preceding Table XLVA are plotted in Figs. 1 to 4, Plate I.

A comparison of these curves with the curve in Fig. 5 of the same plate representing the annual variation suggests the following inferences :—

(1) The curves for the four seasons agree closely in their forms (*i. e.*, in the epochs and character of the critical phases) with the curve of the annual variation. Thus all five curves have a well-marked minimum for the year 1893, and an equally strongly marked maximum in 1896-1897. The monsoon curves (Figs. 3 and 4) agree with the annual curve in having a feebly marked minimum in 1898 and a feeble maximum in 1900. The corresponding cold-weather minimum was in 1899 and the following maximum in 1902.

The hot weather curve differs more largely from the annual curve than any of the other seasonal curves. This is in accordance with the fact that the meteorology of the hot weather period in India depends more largely upon local conditions and less upon general and external conditions than that of the remaining seasons of the year.

(2) A comparison of the temperature curves (seasonal and annual) with the corresponding rainfall curves, Plate III, Figs. 1 to 5, shows that they agree closely in their epochs, but that the phases are opposite in character.

(3) Similarly the comparison of the curves in Plates I and II indicates that the temperature curves are more or less exactly the inverses of the cloud and humidity curves.

(4) The total amplitudes of the variation during the period are greatest for the cold weather season and least for the south-west monsoon period (June to October).

The mean temperature curve for the whole of India is obtained from the data of a large number of stations at which the conditions, more especially those of rainfall and cloud, differ very largely. The following data of seven stations, for which solar radiation da a and curves are given later and for four additional stations, will indicate roughly the extent to which those general variations are modified in different parts of India.

Table XLVI gives the actual annual temperature variation and Table XLVII the *smoothed variations for the eleven selected stations*:—

TABLE XLVI.

Station.	Actual variation of mean temperature in												
	1890.	1891.	1892.	1893.	1894.	1895.	1896	1897.	1898.	1899.	1900.	1901.	1902.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Leh	+2·0	−1·7	+2·0	+0·8	+0·1	+0·1	+0·5	−0·9	+2·4	−0·9	+0·2	−1·0	+0·1
Simla	+0·3	−0·8	+0·7	−3·3	−1·1	−0·1	+0·8	−0·9	−0·2	−0·4	−1·2	−1·4	−0·5
Lahore . . .	+0·3	0	+2·1	−0·5	+0·7	+2·8	+3·1	+1·7	+2·4	+3·6	+1·8	+1·9	+2·6
Jaipur	+0·8	+0·2	+1·3	−1·6	+0·1	+1·1	+2·1	+1·1	+1·9	+2·8	+1·8	+2·0	+2·3
Allahabad . . .	−0·6	−0·6	+1·1	−1·8	+0·1	+0·1	+2·1	+1·4	−0·2	−0·2	+0·5	+0·5	+0·5
Calcutta	−0·1	+0·1	+0·2	−1·4	+0·4	+0·2	+1·1	+0·7	−0·1	+0·6	+1·6	+0·9	+0·5
Nagpur	+0·6	0	+1·0	−1·7	+0·2	+0·5	+2·3	+2·0	+0·4	+2·0	+2·4	+0·4	+2·0
Bombay	−0·2	+0·2	+0·4	−0·6	0	+0·1	+1·2	−0·1	+0·9	+0·5	+0·6	+0·5	+1·7
Belgaum	−0·1	+0·5	−0·2	−1·1	−0·2	+0·1	+1·5	+1·2	+0·2	+0·1	+1·5	+0·5	+0·9
Madras	−0·9	+0·4	−0·5	−0·5	+0·1	−0·2	+0·4	+0·7	−0·4	−0·1	+0·6	+0·5	+0·2*
Aden	−0·3	+0·4	−0·1	+0·6	+0·5	+0·6	+0·7	+0·8	+0·4	+0·4	+0·8	+0·6	+1·1

* Mean of 10 months.

TABLE XLVII.

STATION.	SMOOTHED VARIATION FROM NORMAL OF MEAN TEMPERATURE IN												
	1890.	1891.	1892.	1893.	894.	1895.	1896.	1897.	1898.	1899.	1900	1901.	1902.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Leh	+1·3	+0·2	+0·8	+0·9	+0·3	+0·2	+0·1	+0·3	+0·8	+0·2	−0·4	−0·4	−0·7
Simla . .	+0·4	−0·2	−0·7	−1·8	−1·4	−0·1	+0·2	−0·3	−0·4	−0·6	−1·1	−1·1	−0·9
Lahore . . .	+0·4	+0·6	+0·9	+0·5	+0·9	+2·4	+2·7	+2·2	+2·5	+2·9	+2·3	+2·1	+2·1
Jaipur . . .	+0·6	+0·6	+0·3	−0·5	−0·1	−1·1	+1·6	+1·6	+1·0	+2·3	+2·1	+2·0	+1·9
Allahabad . . .	−0·4	−0·2	−0·1	−0·6	−0·4	+0·6	+1·4	+1·2	+0·2	0	+0·3	+0·5	+0·4
Calcutta . . .	+0·1	+0·1	−0·2	−0·6	−0·1	+0·5	+0·8	+0·6	+0·3	+0·7	+1·2	+1·0	+0·7
Nagpur . . .	+0·6	+0·4	+0·1	−0·6	−0·2	+0·9	+1·8	+1·7	+1·2	+1·7	+1·8	+1·3	+1·2
Bombay . .	0	+0·2	+0·1	−0·2	−0·1	+0·4	+0·6	+0·5	+0·6	+0·6	+0·6	+0·8	+0·9
Belgaum . . .	+0·2	+0·2	−0·3	−0·7	−0·4	+0·4	+1·1	+1·0	+0·4	+0·5	+0·9	+0·9	+0·6
Madras . . .	−0·5	−0·2	−0·3	−0·4	−0·1	0	+0·3	+0·4	−0·1	0	+0·4	+0·5	+0·1
Aden . . .	−0·1	+0·2	+0·2	+0·4	+0·6	+0·6	+0·7	+0·7	+0·5	+0·5	+0·7	+0·8	+0·8

The smoothed values have in this table been obtained from the actual by means of the formula $\beta=\frac{a+2b+c}{4}$. Curves plotted from these smoothed data are given in Plate IV for the eleven stations. The following inferences are suggested by an examination of these curves.

The curves for these stations differ very considerably according to distance from the sea and other circumstances. Simla, Allahabad, Calcutta, Belgaum, Nagpur and Bombay agree fairly closely with the exception that the amplitude of the variation is much less for Bombay than for the other stations. The chief features of the curves for these six stations are a deepish minimum in 1893, a large maximum in 1896, a feeble minimum in 1898 or 1899 (on the average) and a feeble maximum near the end of the period.

It is very noteworthy that the Leh curve is practically the inverse of the Simla and India curves, having a maximum in 1893, a minimum in 1896, a maximum in 1898 and a deepish minimum in 1902. As the Simla curve is similar to the plains curves, its amplitude of variation being as large as that of either Lahore or Allahabad, it is very probable that the inversion of temperature shown by Leh as compared with Simla or India is not an effect due to elevation (and obtaining at the same height over the plains of India) but is a phenomenon of the period over the area including the Tibetan plateau and perhaps Central Asia generally.

The curve for Madras has a small amplitude or range of variation and is similar to the Belgaum curve and hence generally to the Indian curve in the epoch of the maximum and minimum phases.

The Aden curve is interesting. Temperature at that station was above the normal during the period 1892-1902 as at Lahore. There is a feeble maximum in 1896 and minimum in 1899.

The preceding discussion has indicated clearly the most important features of the mean temperature conditions of the period. Temperature was slightly lower than usual during the wet period from 1892 to 1894 and was more or less considerably above it during the dry period. The variations in each of these periods were common, with few exceptions, to every season of the period, and also to each month. They were remarkably persistent and independent of seasonal conditions. The period of increased temperature was unusually prolonged, obtaining from 1895 to 1903 (at least) or for upwards of eight years. The variations were similar in character throughout the period over the whole of the interior of India, both at the plains and hill stations, but probably did not extend to Central Asia or (perhaps) Aden.

Absolute Humidity or Aqueous Vapour Pressure.

The two following tables give data of the mean annual and seasonal variations of the aqueous vapour pressure from the normal (derived from the results of 50 to 80 stations) for each year from 1890 to 1902 for the whole of India. The first table (Table XLVIII) gives the actual or crude data, and the second table (Table XLIX) smoothed data obtained by the use of the formula $\beta=\frac{a+2b+c}{4}$.

The data of the last column in Table XLIX, giving the smoothed variations for the whole Indian area, are plotted in Fig. 5, Plate II, and the data of the first four columns giving the seasonal variations are plotted in Figs. 1 to 4 of the same plate.

Table XLVIII.

Year.	Actual variation from normal of absolute humidity (whole India).				
	Cold weather period, January and February.	Hot weather period, March to May.	South-west monsoon period, June to October.	Retreating south-west monsoon period, November and December.	Whole year.
	"	"	"	"	"
1890	013	+'002	—'010	+ 015	—'003
1891	—'002	+'001	—'015	—'006	—'007
1892	+'007	—'007	+'007	—'026	—'002
1893	—'004	+'017	+'001	+'015	+'007
1894	+'034	'009	+'017	+'016	+ 013
1895	+'017	+'014	— 003	—'011	+'003
1896	—'020	—'014	— 011	+ 006	—'010
1897	+'024	'011	+'016	— 019	+'005
1898	—'020	—'020	+'001	—'003	—'009
1899	—'026	+'008	—'033	—'059	—'026
1900	— 008	'005	+'005	+'015	+'002
1901	+'022	+'001	—'002	—'008	+'002
1902	—'019	+'007	+'006	+'012	+'003

TABLE XLIX.

Year.	Smoothed variation from normal of absolute humidity.				
	Cold weather period, January and February.	Hot weather period March to May.	South-west monsoon period, June to October.	Retreating south-west monsoon period, November and December.	Whole year.
	"	"	"	"	"
1890	—·005	+·002	—·006	+ 002	—·003
1891	—·003	—·001	— 008	—·006	—·005
1892	+·002	+·001	0	—·011	—·001
1893	+·008	+·005	+·007	+·005	+·006
1894	+ 020	+ 003	+·008	+·009	+·009
1895	+ 012	+·001	0	0	+·002
1896	0	—·006	- 002	—·005	—·003
1897	+·002	—·014	+ 006	—·009	— 002
1898	—·011	— 011	—·004	— 021	— 010
1899	— 020	—·002	—·015	—·027	—·015
1900	—·005	0	—·006	—·009	—·005
1901	+·004	+·001	+·002	+·003	+·002
1902	— 004	—·003	+·007	— 001	+·001

A comparison of the curve for absolute humidity, Fig. 5, Plate II, with those for cloud and rainfall (Plate I, Fig. 10, and III, Figs., 5 and 10) shows that they correspond closely in their chief features. The curve for absolute humidity has a large maximum in 1894 and a large minimum in 1899, and has a small or secondary minimum in 1896 and maximum in 1897. The epochs and amplitudes of the variations of the three elements are in fact similar.

The seasonal variations given in the first four columns of the tables show a marked tendency to the same phase of variation in each season of the year during the years of large excess or defect. Thus in each of the years 1893 and 1894, the absolute humidity was in excess in three seasons out of four, and in the two remaining seasons the variations (negative) were small in value. Similarly, in each of the years 1896, 1898 and 1899 the absolute humidity was below the normal in three out of the four seasons, and the positive variations in the remaining season of each of these years were so small as to be of no significance.

The following table gives corresponding data for each month of the period:—

TABLE L.

Year.	Actual variation from normal of absolute humidity (whole India).												
	January.	February.	March.	April	May.	June.	July.	August.	September.	October.	November.	December.	Year.
	"	"	"	"	"	"	"	"	"	"	"	"	"
1890	—·018	—·008	+·007	+·011	—·011	+·015	—·013	—·018	—·020	—·015	—·005	+·035	—·003
1891	—·002	—·002	—·002	0	+·006	—·047	—·028	—·009	+·018	—·007	—·003	—·008	—·007
1892	—·002	+·015	—·049	+·030	—·002	—·001	+·002	+·013	+·015	+·004	—·028	—·023	—·002
1893	—·004	—·003	—·009	+·016	+·043	+·019	0	—·010	+·002	—·004	+·036	—·007	+·007
1894	+·015	+·052	—·009	—·006	—·011	+·031	+·001	—·001	+·018	+·038	+·010	+·021	+·013
1895	+·018	+·016	+·001	+·015	+·027	+·036	—·010	+·001	—·006	—·037	+·010	—·032	+·003
1896	—·032	—·007	—·017	—·021	—·005	+·035	+·015	+·013	—·045	—·072	+·014	—·003	—·010
1897	+·025	+·022	—·019	—·012	—·001	—·015	+·003	+·035	+·037	+·018	—·010	—·027	+·005
1898	—·043	+·003	—·053	+·008	—·015	+·015	+·007	—·007	+·005	—·016	—·019	+·013	—·009
1899	—·054	+·003	—·020	+·010	+·033	—·010	—·019	—·026	—·046	—·064	—·068	—·049	—·026
1900	—·012	—·003	—·010	+·008	—·014	—·015	+·007	+·025	+·034	—·027	—·001	+·031	+·002
1901	+·019	+·025	+·009	—·007	+·002	—·029	0	+·019	—·015	+·017	+·002	—·018	+·002
1902	—·011	—·027	—·001	+·009	+·014	—·014	+·004	—·002	+·024	+·016	+·009	+·015	+·003

The following gives the number of months in each year in which the variations exceeded ·03":—

TABLE LI.

Year.	Number of months in which the variation exceeded ·03".	Largest variation during year.	Mean variation of year.
		"	"
1890	1	+·035	—·003
1891	1	—·047	—·007
1892	1	—·049	—·002
1893	2	+·043	+·007
1894	3	+·052	+·013
1895	3	—·037	+·003
1896	4	—·072	—·010
1897	2	+·037	+·005
1898	2	—·053	—·009
1899	6	—·068	—·026
1900	2	+·034	+·002
1901	0	—·029	+·002
1902	0	—·027	+·003

The data indicate, as might be expected, (1) that the sign of the maximum variation in any year is the same almost without exception as that of the mean variation of the year, (2) that large variations occur chiefly in years of great dryness or dampness and (3) that the negative variations (accompanying greater dryness) are much larger in amount than the positive variations. This is further indicated by the data of the following table giving the annual variability as determined from the monthly variations, *i.e.*, the sum of the variations irrespective of sign divided by twelve:—

TABLE LII.

Year.	Variability of absolute humidity.
	"
1890	·015
1891	·011
1892	·015
1893	·013
1894	·018
1895	·017
1896	·023
1897	·019
1898	·017
1899	·034
1900	·016
1901	·014
1902	·012

The large estimates or values of the variability in 1899 and 1896 are noteworthy.

The following tables give data of the mean annual variations of the aqueous vapour pressure for eleven stations, typical of the whole Indian area:—

TABLE LIII.

Station.	Actual variation of annual mean aqueous vapour pressure from normal in												
	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898	1899.	1900.	1901.	1902.
	"		"	"	"	"	"	"	"	"	"	"	"
Simla	−·019	−·026	−·043	−·007	−·008	−·022	−·024	−·015	−·015	−·032	−·014	−·028	−·026
Lahore	+·014	−·028	−·027	+·028	+·033	+·009	−·009	+·005	−·003	−·043	+·022	−·003	+·004
Jaipur	−·002	−·024	+·001	+·012	+·023	+·014	−·020	+·003	−·036	−·037	+·006	−·026	−·010
Allahabad	−·039	+·02	−·044	+·001	+·022	−·001	−·073	−·004	0	−·032	+·003	+·002	−·006
Calcutta	+·016	−·045	−·049	−·041	−·032	−·055	−·015	−·013	−·034	−·005	+·020	−·011	−·011
Bombay	−·015	−·46	−·010	−·048	−·019	−·029	−·007	−·022	−·015	−·047	−·020	−·013	+·018
Leh	+·007	+·005	+·016	+·005	+·017	−·002	?	−·002	+·004	0	+·007	−·015	−·002
Aden	+·011	−·008	−·031	−0·7	0	−·013	−·045 ?	−·020 ?	−·017	−·042	+·001	−·023	+·005
Nagpur	+·016	−·006	+·012	+·036	+·034	+·082	+·007	+·036	−·022	−·053	−·019	+·023	−·031
Belgaum	+·006	−·016	−·003	−·006	−·003	+·006	−·012	−·016	−·002	−·029	−·023	+·022	+·024
Madras	+·048	+·047	+·032	+·049	+·045	+·028	+·033	+·052	+·032	+·004	+·045	+·042	+·040

TABLE LIV.

STATION.	SMOOTHED VARIATION OF ANNUAL MEAN AQUEOUS VAPOUR PRESSURE FROM NORMAL IN												
	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
	"	"	"	"	"	"	"	"	"	"	"	"	"
Simla	−·020	−·029	−·030	−·016	−·011	−·019	−·021	−·017	−·019	−·023	−·022	−·024	−·027
Lahore	+·006	−·017	−·014	+·016	+·026	+·011	−·001	−·001	−·011	−·017	−·001	+·005	+·004
Jaipur	−·006	−·012	−·003	+·012	+·018	+·008	−·006	−·013	−·027	−·026	−·013	−·014	−·021
Allahabad	−·020	−·010	−·016	−·005	+·011	−·013	−·038	−·020	−·009	−·015	−·006	0	−·011
Calcutta	−·007	−·031	−·046	−·041	−·040	−·047	−·040	−·026	−·022	−·006	+·006	−·003	−·012
Bombay	−·023	−·029	−·029	−·031	−·029	−·021	−·016	−·017	−·025	−·032	−·025	−·007	0
Leh	+·006	+·008	+·011	+·011	+·009	?	?	?	+·002	+·003	0	−·006	−·008
Aden	+·003	−·009	−·022	−·016	−·008	−·018	−·031	−·026	−·024	−·025	−·016	−·010	?
Nagpur	+·005	+·004	+·014	+·030	+·047	+·051	+·033	+·014	−·015	−·037	−·017	−·001	−·012
Belgaum	−·006	−·007	−·007	−·005	−·003	−·003	−·010	−·012	−·012	−·021	−·013	+·011	+·017
Madras	+·050	+·044	+·040	+·044	+·042	+·034	+·037	+·042	+·030	+·021	+·034	+·042	+·045

The data in Table LIV are derived from those of Table LIII by the formula $\beta = \frac{a+2b+c}{4}$.

The curves of the eleven selected stations for this element (charted in Plate V) present large differences. The Simla, Lahore, Jaipur and Nagpur curves agree closely in their general form, and probably represent the law of variation over the whole of the interior of North-Western and Central India and the North Deccan. The curves have, with one or two slight exceptions, maxima values for 1894 and 1901 and minima for 1891, 1896 and 1899, the last being the absolute minimum for Nagpur and Lahore. The curve for Allahabad differs in the epoch of the absolute minimum during the period which is in 1896 and not in 1899, this contrast corresponding with the greater intensity of the 1896 drought than the 1899 drought in that area.

The curves for Calcutta and Bombay differ widely from those of the interior stations. Thus at Calcutta the aqueous vapour pressure was below the normal during nearly the whole period, the deficiency being greatest from 1891 to 1896, and most pronounced in 1892 and 1895. At Bombay it was a minimum in 1893 and a maximum in 1896, and hence opposite in phase to the variation of these years in North-Western and Central India and the North Deccan.

It hence follows that when the south-west monsoon in 1893, 4 gave unusually abundant rain in the interior and an excess of aqueous vapour pressure on the mean of the year at Lahore, Jaipur, Allahabad and Nagpur, the aqueous vapour pressure was a minimum at Bombay and Calcutta. The minimum at Allahabad in 1896 corresponds in the same way to a maximum at Bombay and the minima at Lahore, Jaipur and Allahabad (and also Bombay) in 1899 to a maximum at Calcutta in 1899 and 1900. These inverse relations are interesting for several reasons, more especially as indicating a contrast between the aqueous vapour pressure variations in the coast districts and the interior of India and between the variations in the fields of the two monsoon currents.

The Aden curve agrees closely with the Jaipur and Lahore curves, having maxima in 1894 and 1901, and minima in 1896 and 1899, and hence follows the general law of variation of the precipitation due to the Arabian Sea monsoon current.

The following gives a brief summary of the chief features of the variation of the aqueous vapour pressure in India from the normal in 1892-1902:—

The annual variation of aqueous vapour pressure from the normal on the mean of the whole Indian area during the period (*vide* Fig. 5, Plate II) represents an oscillatory change of long period, the amplitude of which is ·02." The epochs of the minimum values or of the greatest deficiency of pressure were 1891 and 1899, and of the maximum values 1894 and (probably) 1901. The drought period of 1896 is very feebly represented by a small depression on the curve (or feeble secondary minimum). The curves for the cold weather season and the monsoon period or wet season are almost identical in general form with the annual curve, the phases being similar and the maximum and minimum epochs occurring, with perhaps one exception, in the same years. In other words, the variations were the same in general character in the cold weather as in the rains—a most important feature. The curve representing the hot weather law of variation differs greatly from the other three seasonal curves. This is an additional confirmation of the statement made in the preceding discussion on temperature that the meteorological conditions in India during the hot weather are chiefly dependent on local conditions and not on the larger and more general conditions which determine or accompany the abnormal features of the remaining seasons of the year.

An interesting feature brought out by the discussion is the opposition between the variations of the amount of vapour pressure in the lower strata of the air in the coast and interior districts, and also between the fields of the two branches of the monsoon current.

Relative Humidity.—The following tables give the actual and smoothed values of the annual and seasonal variations of the relative humidity from the normal for each year of the period 1890-1902 for the whole of India (deduced from the data of 50 to 80 observatories):—

TABLE LV.

Year.	Actual variation from normal of relative humidity.						
	Whole India.				Year.		
	Cold weather period, January and February.	Hot weather period, March to May.	South-west monsoon period, June to October.	Retreating south-west monsoon period, November and December.	Extra Tropical India.	Tropical India.	Whole India.
1890	−4	−1	0	+2	0	−1	−1
1891	+1	+2	−2	−2	0	−2	0
1892	−2	−4	+1	−2	−2	−1	−1
893	+7	+5	+2	+2	+5	+2	+3
1894	+4	−1	+3	+4	+3	0	+2
1895	+3	+1	−1	−4	0	−1	0
1896	−5	−4	−3	−2	−4	−3	−3
1897	0	−2	−1	−3	−1	−1	−1
1898	−3	−4	0	−2	−2	−2	−2
1899	−4	0	−6	−10	−4	−5	−5
1900	−3	−2	−1	0	−1	−3	−2
1901	+4	0	−3	−3	−2	0	−1
1902	−7	−1	−1	0	−3	−1	−2

TABLE LVI.

Year.	SMOOTHED VARIATION FROM NORMAL OF RELATIVE HUMIDITY.						
	Whole India.				Year.		
	Cold weather period, January and February.	Hot weather period, March to May.	South-west monsoon period, June to October.	Retreating south-west monsoon period, November and December.	Extra Tropical India.	Tropical India.	Whole India.
1890 . . .	−3	−1	−1	0	0	−1	−1
1891 . . .	−1	0	−1	−1	−1	−2	−1
1892 . . .	+1	0	+1	−1	0	−1	0
1893 . . .	+4	+1	+2	+2	+3	+1	+2
1894 . . .	+5	+1	+2	+2	+3	0	+2
1895 . . .	+1	−1	−1	−2	0	−1	0
1896 . . .	−2	−2	−2	−3	−2	−2	−2
1897 . . .	−2	−3	−1	−3	−2	−3	−2
1898 . . .	−3	−3	−2	−4	−2	−3	−3
1899 . . .	−4	−2	−3	−6	−3	−4	−4
1900 . . .	−2	−1	−3	−3	−2	−3	−3
1901 . . .	−1	−1	−2	−2	−2	−1	−2
1902 . . .	−3	−1	−1	−1	−3	0	−2

The smoothed data in Table LVI are obtained from the data of Table LV by the use of the formula $\beta=\frac{a+2b+c}{4}$

The data of the annual variations (Table LVI) are plotted in Fig. 10, Plate II. The curves for relative humidity present the same general features as the corresponding curves for absolute humidity (Fig. 5, Plate II), cloud (Fig. 10, Plate I) and rainfall (Fig. 5, Plate III). The relative humidity curve for the whole of India has a well-marked maximum in 1893 and a deep minimum in 1899, and a feebly indicated minimum and maximum in 1896 and 1897.

The seasonal variations (actual and smoothed) are given in the first four figure columns of Tables LV and LVI. The smoothed data are plotted in Figs. 6 to 9 of Plate II. The curves indicate that the smoothed humidity was in excess in all seasons in 1893 and 1894, the actual increase in the actual mean humidity being greatest in the cold weather of 1893 (+7). In the dry period from 1895 to 1902 the actual mean humidity was for all seasons normal or in defect in six years, *viz.*, 1896-1900 and in 1902. The most noteworthy feature during this period was the great deficiency in the south-west monsoon period (—6) and the retreating south-west monsoon period of 1899 (—10).

Hence the important conclusion that the variations of the mean relative humidity of India tended to be similar in character in each of the four seasons of each year. In the

wet period 1892-4 the smoothed humidity was generally in excess in every season, and in the dry period from 1895-1902 the humidity was in defect in each season almost without exception, and hence, in accordance with the general law, that in years of marked variations of the meteorological conditions from the normal in India there is a very strong tendency for to be the same throughout the year.

The following tables giving actual and smoothed variation data for eleven representative stations in different parts of India show approximately the amount of local variation the type of variation from the general humidity conditions in India during the period:—

TABLE LVII.

STATION.	ACTUAL VARIATION FROM NORMAL OF MEAN ANNUAL RELATIVE HUMIDITY IN											
	1890.	1891.	1892	1893	1894	1895.	1896.	1897.	1898	1899	1900.	1901.	1902
Simla	−3	−2	−8	+7	+3	−1	−3	−1	−2	−6	+1	−2	−4
Lahore	+7	+4	0	+9	+9	+2	−1	+3	0	−6	+4	+2	−1
Jaipur	−2	−4	−2	+3	+3	−1	−5	−2	−7	−10	−3	−5	−6
Allahabad	−2	−2	−7	+4	+1	−2	−13	−5	−2	−5	−2	−2	−3
Calcutta	0	0	−7	−2	−4	−7	−8	−4	−4	−3	−3	−4	−4
Bombay	−1	−5	−2	−3	−2	−3	−4	−3	−4	−6	−4	−3	−2
Leh	+2	−4	+1	+4	+7	−2	?	+1	−1	0	−3	−9	−2
Aden	+3	−1	−2	−2	−1	−2	−5	−3	−2	−4	−1	−3	−2
Nagpur	+1	−1	0	+7	+4	+6	−27	+1	−2	−10	−4	−2	−5
Belgaum	+2	0	+4	+4	+3	+3	−2	−2	+2	−2	−4	+3	+3
Madras	+5	+2	+2	+4	+3	+1	+1	+3	+3	0	+2	+2	+2

TABLE LVIII.

STATION.	SMOOTHED VARIATION FROM NORMAL OF MEAN ANNUAL RELATIVE HUMIDITY IN												
	1890	18t	1892	1893.	1894	1895	1896.	1897.	1898.	1899	1900	1901	1902
Simla	−3	−4	−3	+2	+3	−1	−2	−2	−3	−3	−2	−2	−3
Lahore	+6	+4	+3	+7	+7	+3	+1	+1	−1	−2	+1	+2	+1
Jaipur	−2	−3	−1	+2	+2	−1	−3	−4	−7	−8	−5	−5	−6
Allahabad	−2	−3	−3	+1	+1	−4	−8	−6	−4	−4	−3	−2	−3
Calcutta	0	−2	−4	−4	−4	−7	−7	−5	−4	−3	−3	−4	−4
Bombay	−2	−3	−3	−3	−3	−3	−4	−4	−4	−5	−4	−3	−2
Leh	0	−1	+2	+5	+4	?	?	?	0	−1	−4	−6	?
Aden	+1	0	−2	−2	−2	−3	−4	−3	−3	−3	−2	−2	?
Nagpur	−1	0	+2	+5	+5	+4	+1	−1	−3	−7	−4	−1	−4
Belgaum	+1	+2	+3	+4	+3	+2	−1	−1	0	−2	−2	+1	+3
Madras	+4	+3	+3	+3	+3	+2	+1	+2	+2	+1	+2	+2	+3

The data of the preceding table are plotted in Figs. 1 to 11, Plate VI.

The curves for the eleven stations agree in their general form closely with the corresponding absolute humidity curves (Plate V), and it is hence only necessary to point out very briefly the chief features for the period 1892 to 1902. These are:—

(1) The curves for Simla, Lahore, Jaipur and Allahabad are similar. They have maxima in the years 1893 or 1894 and 1901 and minima in 1896 and 1899. In all the curves the first maximum mentioned is well marked. The absolute minimum is in 1896 for Allahabad and 1899 for Lahore and Jaipur. This difference corresponds with the rainfall variations at these stations, Allahabad being in the centre of the drought area of 1896, and Lahore and Jaipur being more affected by the drought of 1899 than Allahabad.

(2) The air was drier than usual throughout the whole period at Bombay and Calcutta. There was a well marked minimum at Calcutta in 1896 and maximum in 1899. At Bombay the variations were small, the only prominent feature being a minimum in 1899. The Aden curve is, on the whole, similar to that of Bombay, but with a larger amplitude of variation.

Cloud.—The variation of the amount of cloud during the period presents features similar to the variation of rainfall.

The following tables give variation data (actual or crude and smoothed) of the whole Indian area (deduced from observations at 50 to 80 stations) for the year and also for the four seasons of the year:—

TABLE LIX.

Year.	ACTUAL MEAN VARIATION FROM NORMAL OF CLOUD AMOUNT.						
	Whole India.				Year		
	Cold weather period, January and February	Hot weather period, March to May.	South-west monsoon period, June to October.	Retreating south-west monsoon period, November and December.	Extra Tropical India.	Tropical India	Whole India.
1890	−0·5	+0·3	+0·3	+0·4	+0·3	0	+0·2
1891	0	+0·5	0	−0·3	+0·1	−0·1	+0·1
1892	0	−0·5	+0·5	−0·2	−0·1	+0·3	+0·1
1893	+0·8	+0·5	+0·4	+0·4	+0·6	+0·4	+0·5
1894	+0·6	−0·1	+0·7	+0·6	+0·1	+0·6	+0·5
1895	+0·1	+0·1	+0·1	0	+0·1	+0·2	+0·1
1896	−0·5	−0·4	−0·2	+0·7	−0·2	−0·1	−0·2
1897	+0·2	0	+0·2	−0·6	−0·2	+0·2	0
1898	−0·6	−0·5	+0·1	+0·1	−0·3	0	−0·2
1899	−0·3	0	−0·4	−0·6	−0·4	−0·2	−0·3
1900	+0·7	+0·1	0	+0·2	+0·3	+0·1	+0·1
1901	+1·0	+0·2	−0·3	+0·2	−0·2	+0·5	+0·1
1902	−0·6	+0·1	−0·2	+0·2	−0·3	+0·1	−0·1

TABLE LX.

Year.	SMOOTHED MEAN VARIATION FROM NORMAL OF CLOUD AMOUNT.						
	Whole India.				Year.		
	Cold weather period, January and February.	Hot weather period, March to May.	South-west monsoon period, June to October.	Retreating south-west monsoon period, November and December.	Extra Tropical India.	Tropical India.	Whole India.
1890 . . .	−0·3	+0·3	+0·2	+0·1	+0·2	0	+0·2
1891 . . .	−0·1	+0·2	+0·2	−0·1	+0·1	0	+0·1
1892 . . .	+0·2	0	+0·4	−0·1	+0·1	+0·2	+0·2
1893 . . .	+0·6	+0·1	+0·5	+0·3	+0·3	+0·4	+0·4
1894 . . .	+0·5	+0·1	+0·5	+0·4	+0·2	+0·5	+0·4
1895 . . .	+0·1	−0·1	+0·2	+0·3	0	+0·2	+0·1
1896 . . .	−0·2	−0·2	0	+0·2	−0·1	+0·1	−0·1
1897 . . .	−0·2	−0·2	+0·1	−0·1	−0·2	+0·1	−0·1
1898 . . .	−0·3	−0·3	0	−0·3	−0·3	0	−0·2
1899 . . .	−0·1	−0·1	−0·2	−0·2	−0·2	−0·1	−0·2
1900 . . .	+0·5	+0·1	−0·2	0	0	+0·1	0
1901 . . .	+0·5	+0·2	−0·2	+0·2	−0·1	+0·3	+0·1
1902 . . .	0	+0·1	−0·2	+0·1	−0·3	+0·2	−0·1

The data of the first four and last figure columns of Table LX are plotted in Figs. 6 to 10, Plate I.

A comparison of the curve, Fig. 10, Plate I, giving the annual variation for the whole period 1892-1902 with the curve showing the annual variation of the mean rainfall of India (see Fig. 5, Plate III) establishes that they agree in all their more important features. The following gives the chief agreements:—

(1) Cloud was in excess from 1890 to 1895, corresponding to the wet period. There was a large and well-marked maximum of cloud in 1893 or 1894 corresponding to the period of greatest excess of rain.

(2) Cloud in general was below the normal from 1896 to 1902. There were two periods of actual minimum cloud amount, *viz.*, 1896 and 1899, separated by a very feeble maximum in 1897. The absolute minimum was in 1899. The epochs of the maximum and minimum values or phases and the amplitudes of the variations of cloud and of rainfall correspond closely.

(3) An examination of the curves giving the seasonal variations shows that there was a marked tendency to similarity of variation throughout the whole year, more especially in the years of most pronounced features. Thus, the

smoothed mean cloud amount was in excess in every season of the year in 1893 and 1894, years of large excess of precipitation. It was, on the other hand, normal or in defect in all seasons in 1898 and 1899, and in three seasons out of four in 1896 and 1897. Also the absolute maximum of the variation of the actual cloud amount of each season was (apart from the exceptional November and December of 1896) in the year 1893 or 1894, and the absolute minimum in 1896 or 1899.

The preceding discussion has shown that rainfall was characterized by a similar feature, *viz*, that the variations were the same in character in the dry as in the wet seasons or periods of the years of largest excess, and also of the greatest deficiency of rainfall, and hence that the causes of these variations are to be sought in more general actions or conditions than those of the south-west monsoon period only.

A comparison of the curves for humidity and cloud shows a parallelism not only for the annual but also for the seasonal variations. Hence the important conclusion that the variations of the amount of aqueous vapour present in the air during the whole period were similar through the lower and middle atmospheric strata up to the field of condensation in both wet and dry seasons, *i.e.*, to at least 20,000 feet in the former and 30,000 feet in the latter season.

The following tables give actual and smoothed values of the annual variation of the cloud amount for each year of the period 1890-1902 at eleven stations typical of the whole of India generally. Table LXI gives the actual or crude data and Table LXII the smoothed data (by the employment of the formula $\beta = \frac{a+2b+c}{4}$) :—

TABLE LXI.

Station.	Actual variation from normal or mean cloud amount in												
	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
Simla	+0·2	+0·6	−0·3	+0·9	+0·8	+0·1	+0·3	+0·1	−0·1	−0·8	+0·7	−0·6	−0·5
Lahore	+0·9	+0·4	+0·2	+0·4	+0·4	−0·1	−0·1	−0·2	−0·5	−0·3	+0·3	−0·6	−0·6
Jaipur	+0·7	+0·2	+0·3	+0·9	+0·8	+0·4	−0·1	−0·2	−0·3	−0·7	+0·2	−0·1	−0·3
Allahabad	+0·4	+0·4	+0·1	+1·2	+1·1	+0·3	−0·4	+0·2	0	−0·3	+0·7	+0·2	+0·
Calcutta	−0·1	−0·1	−0·3	+0·8	+0·1	−0·2	−0·4	+0·3	−0·2	+0·2	+0·4	+0·3	+0·2
Bombay	−0·2	−0·7	−0·4	−0·5	−0·3	−0·5	−0·6	−0·6	−0·7	−1·0	−0·5	−0·2	−0·5
Leh	+0·1	+0·2	+0·4	+0·1	+0·1	−0·1	+0·1	+0·1	−0·1	−0·4	0	−0·9	−0·7
Aden	−0·2	−0·4	−0·8	−0·7	−0·6	0	+0·5	0	+0·6	−0·4	+0·7	+0·2	+0·9
Nagpur	0	−0·5	−0·3	+0·3	+0·1	+0·1	−0·3	−0·1	−0·2	−0·3	+0·6	+0·6	−0·5
Belgaum	−0·1	−0·5	+0·1	+0·3	+0·3	−0·2	−0·6	−0·6	−0·2	−0·7	−0·4	+0·8	+0·4
Madras	0·4	+0·1	−0·3	+0·4	−0·1	0	−0·2	+0·3	+0·1	−0·1	+0·1	+0·2	−0·1

TABLE LXII.

STATION.	SMOOTHED VARIATION FROM NORMAL OF MEAN CLOUD AMOUNT IN												
	1890	1891.	1892.	1893.	1894.	1895.	1896	1897.	1898.	1899.	1900.	1901.	1902
Simla . .	+0·2	+0·3	+0·2	+0·6	+0·7	+0·3	+0·2	+0·1	−0·2	−0·3	0	−0·3	−0·4
Lahore . . .	+0·6	+0·5	+0·3	+0·4	+0·3	0	−0·1	−0·3	−0·4	−0·2	−0·1	−0·4	−0·5
Jaipur . . .	+0·5	+0·4	+0·4	+0·7	+0·7	+0·4	0	−0·2	−0·4	−0·4	−0·1	−0·1	−0·2
Allahabad . . .	+0·4	+0·3	+0·5	+0·9	+0·9	+0·3	−0·1	0	0	0	+0·3	+0·3	+0·2
Calcutta . . .	0	−0·2	0	+0·4	+0·2	−0·1	−0·2	0	0	+0·2	+0·3	+0·3	+0·3
Bombay . . .	−0·4	−0·5	−0·5	−0·4	−0·4	−0·5	−0·6	−0·6	−0·8	−0·8	−0·6	−0·4	−0·4
Leh	+0·2	+0·3	+0·3	+0·2	+0·1	−0·1	0	+0·1	−0·1	−0·2	−0·3	−0·6	−0·7
Aden	−0·4	−0·5	−0·7	−0·7	−0·5	0	+0·3	+0·3	+0·2	+0·1	+0·3	+0·5	+0·5
Nagpur . . .	−0·2	−0·3	−0·2	+0·1	+0·2	0	−0·2	−0·2	−0·2	−0·1	+0·4	+0·3	−0·2
Belgaum . . .	−0·2	−0·3	0	+0·3	+0·2	−0·2	−0·5	−0·5	−0·4	−0·5	−0·2	+0·4	+0·4
Madras . . .	−0·3	−0·2	−0·1	+0·1	+0·1	−0·1	0	+0·1	+0·1	0	+0·1	+0·1	−0·1

The data of the preceding table are plotted in the curves of Figs. 1 to 11, Plate VII.

The Simla, Lahore, Jaipur, Allahabad, Calcutta, Nagpur and Belgaum curves agree in their general form, and probably represent the variation of the cloud amount for the interior of India (except the southern half of the Peninsula) during the period under discussion. These curves, whilst differing in the amplitude of the oscillatory variations, agree in the epochs of the critical phases. All these curves show a maximum of cloud in 1893 and 1894, a minimum in 1898 or 1899, a maximum in 1900 or 1901, and a minimum (probably) in 1902. The Allahabad curve shows also a minimum in 1896.

The Bombay curve agrees generally with those for Northern India, more especially in the 1893-94 maximum and the 1898-99 minimum.

The Leh curve differs considerably from the Simla and Lahore curves, the most important feature being a fairly steady diminution of cloud amount from 1890 to 1902. The Aden curve is a well-defined curve of large amplitude, in which the phases are the opposite of the Indian curves, although the epochs of the critical periods are identical, *viz.*, 1893, 1896, 1899 and (probably) 1902.

Pressure.—This element of observation is of the greatest importance, as it undoubtedly throws some light upon the abnormalities of the air movement during the period.

It appears to be desirable to give some evidence of an important principle of Indian meteorology, *viz.*, the remarkable homogeneity of the long period pressure variations over the Indian area.

The following table gives annual variation data for the period 1890-1902 of nine representative stations:—

TABLE LXIII.

Year.	Actual annual variation of 8 A.M. pressure.								
	Colombo.	Madras.	Bombay.	Nagpur.	Rangoon.	Calcutta.	Allahabad.	Jaipur.	Lahore.
	"	"	"	"	"	"	"	"	"
1890	+·002	—·005	+·002	+·001	—·005	—·008	—·009	—·009	—·018
1891	?	+·010	+·020	+·016	—·005	+·039	+·007	+·013	+·020
1892	?	—·021	—·023	—·011	—·024	—·015	—·035	—·021	—·029
1893	—·003	—·001	+·002	+·006	—·008	+·007	—·001	+·004	+·008
1894	—·008	—·016	—·005	—·010	—·015	—·013	—·017	—·012	—·015
1895	—·007	+·002	+·007	+·011	—·007	+·005	+·004	+·008	+·005
1896	—·003	+·006	+·009	+·003	—·004	—·014	—·005	+·005	0
1897	—·015	—·012	—·003	—·003	—·027	—·004	—·007	—·001	—·003
1898	—·028	—·017	—·015	—·003	—·026	—·018	—·021	—·016	—·026
1899	+·004	+·006	+·021	+·017	—·001	0	—·004	+·004	—·006
1900	+·007	+·008	+·016	+·005	+·002	+·011	+·003	+·010	+·015
1901	—·001	—·007	+·010	+·013	—·009	—·001	—·005	+·010	+·008
1902	+·007	+·010	+·003	+·023	+·001	+·021	+·017	+·016	+·016

The following inferences are based on an examination of the preceding data:—

(1) The mean annual variations are usually small quantities.

(2) The sign or character of these variations was the same for all stations, or for all stations except one, in seven years out of the thirteen.

(3) The annual variations were very small, and within the limits of the probable error (assumed to be ·003") due to the various causes operating in the registration of barometric observations in a considerable number of cases. Also only ten per cent. of the variations exceeding ·003" in amount were of the opposite sign to the sign of the majority of cases in each year.

(4) Hence the general conclusion that the long period pressure variations which are disclosed by the barometric observations in India are usually common to the whole of that large area, and are hence a general and probably an important feature of the meteorology of that area.

Similar conclusions follow from an examination of the monthly variation data. It

will be sufficient to give the data for the same stations for each month of the typical years 1893, 1896 and 1899:—

TABLE LXIV.

Year.	Month.	Actual mean monthly variation of 8 A.M. pressure.								
		Colombo	Madras.	Bombay	Nagpur.	Rangoon.	Calcutta.	Allahabad	Jaipur.	Lahore.
		"	"	"	"	"	"	"	"	"
1893	January	?	−·044	−·039	−·035	−·053	−·048	−·056	−·046	−·046
	February	?	−·009	+·010	+·011	−·024	+·020	+·020	+·008	+·025
	March	?	−·005	−·005	+·038	−·015	+·035	+·030	+·025	+·030
	April	−·012	−·018	−·014	−·018	−·028	−·005	−·027	−·018	−·014
	May	+·014	−·008	0	−·019	−·022	−·052	+·002	+·009	+·019
	June	−·021	+·013	−·017	+·011	+·015	+·052	+·024	+·001	+·040
	July	−·032	−·012	+·022	+·038	−·001	+·041	+·026	+·023	−·014
	August	+·024	+·022	+·021	+·003	−·018	+·011	−·004	+·027	+·011
	September	+·008	+·006	−·008	−·015	−·025	−·039	−·046	−·033	−·025
	October	−·005	−·013	+·001	−·012	−·016	−·015	−·030	−·010	−·010
	November	+·004	+·021	+·018	+·036	+·052	+·051	+·032	+·048	+·062
	December	+·020	+·035	+·032	+·0.9	+·035	+·029	+·014	+·015	+·015
1896	January	−·003	+·003	+·008	+·007	−·009	−·013	+·002	−·007	−·014
	February	+·014	−·001	+·023	?	0	−·040	−·022	−·021	−·011
	March	−·024	−·025	−·120	−·014	−·028	−·041	−·029	−·008	−·005
	April	−·031	−·021	−·024	−·035	−·026	−·054	−·040	−·026	−·027
	May	+·026	+·003	+·044	+·004	−·005	+·003	−·013	+·016	−·006
	June	−·030	−·010	−·048	−·019	−·013	−·025	−·012	−·019	+·001
	July	+·010	0	+·104	−·027	−·025	−·042	−·006	+·014	−·003
	August	+·030	+·028	+·022	−·008	0	−·028	−·006	+·023	+·007
	September	−·023	+·016	+·048	+·065	+·006	−·003	+·024	+·043	+·007
	October	+·029	+·063	+·052	+·055	+·011	+·040	+·021	+·028	+·025
	November	−·031	−·003	−·020	−·015	+·001	−·002	−·017	−·010	−·011
	December	+·007	+·019	+·014	+·020	+·039	+·039	+·034	+·024	+·032
1899	January	−·011	−·011	+·014	0	−·034	−·007	−·003	−·003	+·011
	February	−·026	−·040	−·028	−·035	−·034	−·050	−·050	−·051	−·052
	March	−·010	−·013	−·010	+·005	−·027	−·028	−·021	+·008	−·006
	April	−·012	−·005	−·002	+·012	−·021	+·006	+·005	−·018	+·002
	May	+·003	−·014	+·004	−·002	−·028	−·042	−·028	−·014	−·028
	June	+·013	+·012	−·010	+·008	+·034	+·033	−·004	−·008	−·004
	July	+·008	+·019	+·066	+·045	−·019	−·007	−·001	+·022	−·032
	August	−·005	−·010	+·046	+·020	−·037	−·020	−·008	+·036	−·016
	September	+·024	+·023	+·075	+·066	+·019	+·032	+·033	+·052	+·026
	October	+·005	+·020	+·019	+·042	+·042	+·048	+·032	+·020	+·036
	November	+·032	+·068	+·052	+·030	+·044	+·038	+·006	+·008	+·003
	December	+·025	+·037	+·020	+·014	+·002	−·001	−·014	−·005	−·012

An examination of the data shows that in 1893 the variations were of the same sign (or were unimportant on account of their smallness, *i.e.*, less than ·006″) in five months out of the twelve, in 1896 in six months of the year, and in 1899 in six months. Also the discrepancy between the signs of pressure variations in the remaining months shows a noteworthy consistency, the great majority of the stations agreeing, the opposite sign or variation in the remaining cases being due to local variations accompanying local or provincial variations of temperature or rainfall; of the variations in the preceding table which exceeded ·003″ only about 18 per cent. differed in sign from that of the majority of the variations of the month in which they occurred. The data hence indicate that in any year or any month of a year it is at least an even chance that the variations of pressure (usually small in amount) will be the same in character over the whole Indian land area, only differing to a moderate extent in amount.

The principle is of the greatest importance, as progress in this and similar enquiries depends largely upon the correct interpretation of the variations of the air movement in the middle and upper atmospheric regions over India from the normal, and this can only be done at present from pressure and cloud (and perhaps rainfall) observations.

It may perhaps be pointed out that changes of pressure are due largely to air movement. The energy utilized is chiefly that of solar radiation directly or indirectly transferred or transformed first into the potential energy of the air pressure and afterwards into the kinetic energy of moving air masses. There appears to be too great a tendency to assume that abnormalities of the weather are explained when accompanying abnormal pressure conditions are shown to be present. An explanation in such an enquiry or discussion as the present can only be considered adequate when it shows variations in the amount and character of the air movement over the area affected, and assigns also some physical cause for these variations.

The fundamental enquiry in the present discussion is undoubtedly the variations in the direction, intensity, and character of the great air movements over India and the Indian Ocean. It may perhaps be possible in the distant future to work out this more or less fully by means of kites, balloons, etc. This is, however, not possible at present and it is hence necessary to employ indirect methods. The only element of observation which throws much light on the subject is that of pressure.

The air pressure at any given place is undoubtedly dependent on the actual density, temperature and velocity of movement at the place. It is in a state of constant fluctuation, due chiefly to changes of density and temperature, these either giving rise to or resulting from air movements over the neighbourhood up to the limits of atmosphere. The question as to how far pressure is modified by the velocity of the air has not yet been determined by meteorologists. Theory undoubtedly shows that in a frictionless fluid with velocity and force potentials pressure at a point diminishes as the velocity increases if the density and temperature be maintained constant. Probably a similar relation obtains in a viscous fluid. To what extent this is true for the ordinary viscous atmosphere can only at present be conjectured.

It is practically or actually assumed by meteorologists in their theoretical discussions that the pressure of the air on or near the earth's surface, or as it is usually expressed the pressure of the air per unit area, is equal to the weight of the superincumbent mass of air over horizontal unit surface at the place where the pressure is measured, and hence that a change of pressure implies necessarily a corresponding increase or decrease of the mass of the superincumbent air.

It would be very desirable to ascertain whether the principle enunciated in the preceding paragraph is true:—

(*a*) In the case of the long period variations of pressure in India which are usually of comparatively small amplitude.

(*b*) In the case of short period variations of moderate amplitude, *e.g.*, the diurnal oscillation.

(*c*) In the case of the rapid fluctuations that occur during thunderstorms, cyclonic squalls, etc.

The principle is very probably true within the limits of the probable errors of observation of air pressure for (*a*) and (*b*), but is almost certainly not true for (*c*). These inferences from theory are apparently in accordance with, and are perhaps confirmed by, the following evidence:—

(1) The occasional remarkable persistency of the long period variations of the same sign in India. For example, pressure was in excess over the Indian area from

September 1876 to August 1878. It appears to be extremely improbable that this should be a mere dynamic effect.

(2) The more prominent features of the vertical pressure anomalies, which are in the great majority of instances in India in accord with the ordinary explanation of the effects of increasing temperature on the vertical distribution of the mass of the atmosphere over a given area at different levels.

(3) The fairly regular oscillatory character of the long period oscillations and their similarity in epochs (and therefore of periods) and amplitudes over very large areas in the Indo-oceanic region.

The following gives the results of the examination of important pressure conditions *and variations in the Indian monsoon area during the period 1891-1903 under the* heads :—

(1) Long period oscillations or variations of pressure.

(2) Vertical pressure anomalies.

(3) Hot weather variations of pressure.

(1) *Long period variations of pressure from 1890-1903.*—The importance of these long period variations in India was shown in my memoir on "A preliminary discussion of certain oscillatory changes of pressure of long period and of short period in India" (Indian Meteorological Memoirs, Vol. VI.). The present section is virtually a continuation of a portion of that paper.

The following tables give actual and smoothed data of the mean monthly variations of pressure from the normal in India (derived from the 8 A.M. means of about 228 observing stations). The smoothing process is carried out by the formula $\beta = \frac{a+b+c}{3}$, where a, b and c are three consecutive crude or actual values, and β is the smoothed value of the middle term (b) :—

TABLE LXV.

Month.	Actual mean monthly variation of 8 A.M. pressure in the Indian area from the normal											
	1891.	1892	1893.	1894.	18	1896	1897.	1898.	1899	1900.	1901.	1902.	1903
	"	"	"	"	"	"	"	"	"	"	"	"	"
January	+·005	+·007	−·043	−·020	−·109	−·003	−·003	+·017	−·003	−·004	+·011	−·012	+·016
February	+·022	−·060	+·008	+·010	+·009	−·012	−·036	−·077	−·040	−·008	+·020	+·088	+·068
March	+·015	−·076	+·017	−·017	−·018	−·022	−·020	−·013	−·010	+·006	+·045	−·015	−·012
April	+·028	−·044	−·013	−·019	+·013	−·033	+·039	−·017	−·001	+·022	−·004	+·002	+·029
May	+·015	−·022	−·011	−·023	−·007	+·013	−·005	−·009	−·019	+·061	+·012	+·009	+·038
June	+·014	+·007	+·016	−·022	+·019	−·016	−·011	−·025	+·009	0	−·002	+·025	+·015
July	−·031	−·035	+·015	+·006	+·022	−·010	0	−·018	+·006	+·006	−·014	−·017	−·025
August	+·012	+·014	+·011	−·022	−·013	+·005	−·015	−·020	0	−·025	−·028	+·009	−·001
September	−·003	−·026	−·022	−·018	+·017	+·021	+·024	+·002	+·038	+·028	+·045	−·002	−·002
October	+·035	−·016	−·011	−·033	+·002	+·040	−·016	−·006	+·034	+·040	−·025	+·077	−·054
November	+·004	−·015	+·039	+·038	+·033	−·008	−·008	−·026	+·030	−·004	−·010	+·041	−·009
December	+·041	+·035	+·029	+·003	−·002	+·030	+·003	−·028	+·006	+·012	+·019	−·022	−·018
Year	+·013	−·019	+·003	−·010	+·006	0	−·004	−·018	+·004	+·011	+·006	+·015	+·004

TABLE LXVI

Month	Smoothed mean monthly variation of 8 A.M. pressure in the Indian area from the normal.												
	1891	1892	1893.	1894	1895	1896	1897.	1898.	1899	1900.	1901	1902	1903
	"	"	"	"	"	"	"	"	"	"	"	"	"
January	+ 009	— 004	0	+ 006	+ 001	— 006	— 003	— 019	— 024	—·007	+·014	+ 032	+ 021
February	+ 014	— 043	—·006	— 009	—·006	— 012	— 020	— 024	—·018	—·002	+ 025	+ 020	+ 024
March	+ 022	— 060	+·004	— 009	+ 001	— 022	— 006	— 036	— 017	+ 007	+ 020	+ 025	+ 028
April	+ 019	— 047	— 002	— 020	— 004	— 014	+ 005	—·013	— 010	+ 030	+ 018	— 001	+ 018
May	+ 019	— 020	— 103	—·021	+ 008	— 012	+ 008	— 017	— 024	+·028	+·002	+ 012	+·027
June	— 001	— 017	+·007	— 013	+·011	— 004	— 003	— 017	— 001	+·022	— 001	+·006	+ 009
July	—·002	— 005	+ 014	— 013	+ 009	— 007	— 009	— 021	+ 005	— 006	— 015	+ 006	—·005
August	— 007	— 016	+·001	— 011	+ 009	+ 005	+ 003	—·012	+ 015	+·033	+ 001	— 003	— 009
September	+ 015	— 009	— 007	—·024	+ 002	+ 022	— 003	— 008	+ 024	+ 014	— 003	+ 028	— 009
October	+ 012	— 019	+ 002	— 001	+ 017	+ 018	0	— 010	+ 034	+·021	+·003	+ 039	— 022
November	+ 027	+ 031	+ 019	+ 003	+ 011	+ 021	— 007	— 020	+ 023	+·016	— 005	+ 032	—·027
December	+ 017	— 008	+·016	+·010	+ 009	+·036	+ 004	—·019	+ 011	+ 006	— 021	+ 012	—·006
Year	+·012	— 021	+ 004	—·009	— 005	0	—·003	— 018	+ 003	+·011	+ 005	+ 017	+·003

The data are plotted in Fig. 1 of Plates XIV, XV and XVI

A brief examination of the data shows at once the persistence for more or less prolonged periods of practically continuous increased or deficient pressure over the Indian area. The following is a summary of these periods during the twelve years 1891 to 1902.

TABLE LXVII

Period		Per od.
August 1890 to December 1891	In excess	17 months
January 1892 to May 1893	In defect	17 "
June 1893 to January 1894	In excess	8 "
February 1894 to October 1894	In defect	9 "
November 1894 to December 1895	In excess	14 "
January 1896 to July 1896	In defect	7 "
August 1896 to December 1896	In excess	5 "
January 1897 to June 1899	In defect	30 "
July 1899 to May 1901	In excess	23 "
June 1901 to December 1901	In defect	7 "
January 1902 to June 1903	In excess	18 "

The epochs of change from one phase (excess to deficiency, and *vice versâ*) for the whole period are given below :—

December-January	1891-2
May-June	1893
January-February	1894
October-November	1894
December-January	1895-6
July-August	1896
December-January	1896-7
June-July	1899
May-June	1901
December-January	1901-2
June-July	1903

There is a remarkable consistency in this feature, four out of seven cases occurring in January and two in June, the former virtually at the commencement of the dry season, and the latter at the beginning of the south-west or wet monsoon.

The preceding data hence indicate that the changes of pressure conditions from a given phase to the opposite almost invariably occur either at the commencement of the dry season or the wet season.

The data further indicate that the pressure changes are of the nature of long period oscillations. Their character is confirmed by the long period oscillations of the vertical anomalies.

Figs. 2, 3 and 4 of Plates XIV, XV and XVI give curves showing the vertical pressure anomalies for three pairs of stations, *viz.*, Leh and Lahore, Simla and Ludhiana, and Quetta and Jacobabad, month by month for the same period. The data from which these curves are plotted will be found in Appendix C, Nos. 26, 27 and 28.

An examination of these curves shows that they present long period oscillations of the same periods, but of inverse phases, the maxima of these vertical anomaly curves corresponding in time with the minima of the India variation curve, and *vice versâ*.

The long period oscillations of the vertical pressure anomalies are usually of larger amplitude than the long period oscillations of the pressure anomalies of India. The amplitude of the former is roughly proportional to the difference of elevation of the pair of stations, and is hence throughout much greater for the Leh-Lahore pair of stations than for the other two pairs. The most noteworthy of the oscillations of the vertical anomalies during the period 1891-1902 are (1st) from March 1891 to February 1893, the amplitude of which for the Leh-Lahore pair was over two-tenths of an inch(·2″), and (2nd) from January 1901 to April 1903, the amplitude of which for the Leh-Lahore pair was approximately ·15″.

It was also stated in the memoir that the south-west monsoon rainfall in any year is on the mean of the Indian area generally in defect when the period coincides with the first half or the period of rising pressure of a long period oscillation, and that the rainfall is in excess when the period comcides with the second half or period of decreasing pressure of a long period oscillation. The dry years of 1896, 1899 and 1902, and the years 1893 and 1897 of increased monsoon rain are fairly in accordance with the above rule. Hence the experience of the period, 1892-1902, is in moderate accordance with that of the previous 15 years as formulated in the memoir and repeated above.

The preceding data confirm the inferences (*vide* page 116 of my memoir), *viz.*, "there are well defined pressure oscillations of small amplitude and long period in the Indian area. Their existence is indicated even more clearly by the pressure observations taken at the hill stations in Northern India up to the level of 11,000 feet, than by the observations taken at the plains stations. The periods of these oscillations vary, but all are very approximately multiples of the natural division of the year determined by the great atmospheric movements over India. The maximum and minimum epochs of the oscillations occur at definite periods of the year clearly related to the great atmospheric movements in India. The primary minimum epochs, for example, occur near the end of the south-west monsoon period or at the beginning of the dry season, and the primary maximum near the end of the cold weather or north-east monsoon in March. These oscillations are also directly related to the distribution of the seasonal rainfall in India."

In the memoir it is also pointed out that the mean pressure variations of the Indian area under discussion are probably due in part to general actions and movements over the Indian Ocean and Indian monsoon area and in part probably to local actions and conditions in India or Southern and Central Asia, and that the former can be separated by a general consideration of the data for the hill stations and for the Indian Ocean.

This method has been employed to determine the former part of the variations and is shown by the dotted curves in Fig. 1, Plates XIV, XV, and XVI, where the full or continuous line represents the data of Table LXVI. The epochs and periods and amplitudes of the long period general oscillations during the period under discussion, as determined from the dotted or free hand curves, were as follows:—

Epochs of long period oscillation.		
Epoch of maximum.	Epoch of minimum.	Approximate period of oscillation.
March 1891 . . .	March 1892 . . .	
March 1893 . . .	May 1894 . . .	2 years.
May 1895 . . .	March 1896 . . .	2 years.
March 1897 . . .	March 1898 . . .	2 years.
December 1899 . . .	July 1900 . . .	2½ years.
January 1901 . . .	January 1902 . . .	1½ years.
March 1903 . . .		

If the long period oscillations were due to a larger or smaller exchange of air between Southern Asia and the Indian Ocean accompanying the great atmospheric movements and their seasonal changes in those areas, it would follow that an increase of pressure due to that movement in Southern Asia would accompany decreased pressure in the Indian Ocean, and *vice versâ*. It was shown in the memoir that the pressure variation at Mauritius from 1877 to 1889 presented long period oscillations or variations of similar period but opposite phases to the pressure variation in India, and hence of the same period and phases as the variations of the vertical anomalies for the hill stations in Northern India.

Pressure variation data for Hongkong, Mauritius, Batavia and Perth are given in tables numbered 29 and 32 to 37 of the Appendix, and are plotted in Figs. 1 to 4 of Plates XVII, XVIII and XIX.

The Batavia curve generally agrees with the Mauritius curve, the only important difference being that the amplitudes of the oscillations are much smaller for the former than the latter. Both curves exhibit minima in March 1892, January 1895, November 1898, April 1901 and December 1902, and maxima in July or August 1893, August 1896, December 1899 and December 1901. The oscillations were hence of long period, the first of 3 years, the second of 4 years, the third of $2\frac{2}{3}$ years, and the fourth of $1\frac{1}{3}$ years. The Mauritius curve is approximately similar in phase and character to the Idia curve from 1891 to 1900, and hence inverse to the vertical anomaly curves, whereas from 1901 to 1903 it is inverse to the Indian curve and similar in phase and period to the vertical anomaly curve.

This suggests that the most important factor in determining the long period oscillations from 1892 to 1900 was not the variations in the ordinary seasonal or monsoon transfer of air between Central and Southern Asia on the one hand and the Indian Ocean on the other. Some other large factors obtained during that period, most probably movements of a more general character and of greater massiveness and extension. This it will be seen is confirmed below by other data.

The Perth variation data are interesting as they show large oscillations comparable with those of the Leh-Lahore vertical anomalies in amplitude. They were of similar period and of similar phase to the latter from 1892 to the middle of 1895, but of opposite phase from the middle of 1895 to 1901.

In the two following tables are given the actual and smoothed annual variations of pressure for the period 1891–1902 (so far as available) for seven stations in China, Australia, the Cape Colony and the Indian Ocean :—

TABLE LXVIII.

Year.	Actual pressure variation from annual mean.						
	Batavia (from mean of day).	Singapore (9 A.M.).	Hongkong (from mean of day).	Zika-wei (from mean of day).	Royal Observatory, Cape of Good Hope (8 A.M.).	Perth (from mean of day).	Adelaide (9 A.M.).
	"	"	"	"	"	"	"
1891	+·016	+·007	—·006	—·004	+·007	+·024	+·045
1892	—·016	—·033	—·005	+·004	—·007	—·011	—·015
1893	—·012	—·039	+·012	+·014	—·007	—·049	—·045
1894	—·002	—·035	—·001	+·001	+·001	+·002	—·001
1895	—·001	—·014	+·001	—·014	—·010	+·012	+·002
1896	+·013	+·007	+·002	—·002	+·013	0	+·013
1897	+·002	+·016	—·001	+·006	+·009	+·005	+·008
1898	—·018	+·002	—·033	—·021	—·002	—·031	—·027
1899	+·007	+·024	0	+·003	+·004	—·005	+·017
1900	+·009	+·022	+·009	+·009	—·004	—·010	
1901	+·006	+·019	+·009			+·008	
1902	·	+·019	+·013				

TABLE LXIX.

Year.	Smoothed pressure variation from annual mean.						
	Batavia (from mean of day).	Singapore (9 A.M.).	Hongkong (from mean of day).	Zika-wei (from mean of day).	Royal Observatory, Cape of Good Hope (8 A.M.).	Perth (from mean of day).	Adelaide (9 A.M.).
	"	"	"	"	"	"	"
1892	—·004	—·022	0	+·005	—·002	—·012	—·005
1893	—·010	—·036	+·002	+ 006	—·004	—·019	—·020
1894	—·005	—·029	+·004	0	—·005	—·012	—·015
1895	+·003	—·014	+·001	—·005	+·001	+·005	+·005
1896	+·005	+·003	+·001	—·003	+·004	+·006	+·008
1897	—·001	+·008	—·011	—·006	+·007	—·009	—·002
1898	—·003	+·014	—·011	—·004	+·004	—·010	—·001
1899	—·001	+·016	—·008	—·003	—·001	—·015	
1900	+·007	+·022	+·006			—·002	
1901		+·020	+·010				

The data are plotted in curves, Plates XX and XXI. The curves of the corresponding data for Mauritius, Zanzibar and the Seychelles will be found in Plate XXII. These curves are very interesting and deserve careful study, more especially in comparison with the corresponding curve for mean India.

The most important features are the following:—

(1) A remarkable deficiency and minimum of pressure in the year 1893 of excessive rain in the Indian region over the large area represented by the stations of Batavia, Singapore, Cape Town, Perth and Adelaide, and hence probably over the southern Indian Ocean and adjacent land area. Accompanying this was an excess or maximum of pressure in India and at Zanzibar, Mauritius, Hongkong and Zika-wei, and hence probably over the whole of Southern Asia. This contrast of the pressure variations between the areas north and south of the equator is in accordance with the experience of the period 1875-1889. This feature is very clearly shown by comparison of the curves in Plate XX.

(2) A slight to moderate excess of pressure in 1896 at Batavia, Singapore, Adelaide, the Cape, Mauritius, Zanzibar, the Seychelles, Hongkong and was normal at Perth and in the Indian area on the mean of all stations. This feature was hence exhibited in areas north and south of the equator.

(3) A large and general deficiency of pressure in 1898 over the whole area including Southern Asia and the Indian Ocean. The deficiency was as marked at Hongkong and Zika-wei as at Perth and Adelaide and was nearly as large on the mean of the whole Indian area. It was very slightly exhibited at the Cape, but ranged between '02" and '03" at Batavia, Hongkong, Zika-wei, Perth, Adelaide, Mauritius, the Seychelles and India.

(4) A general slight to moderate excess of pressure in 1899 over the same extensive area similar in character and extension to the excess in 1896.

The period from 1895 to 1901 hence presents the same phases of pressure variation over the Indian Ocean and Southern Asia (so far as is indicated by the available data). The usual relation based upon previous investigations is for the pressure variations in Southern Asia to be of opposite character or sign to those of the Indian Oceanic region. Hence it is evident that during the dry period, from 1895 to 1901, there were disturbing actions of great magnitude which gave rise to large general variations of pressure probably over at least half the Eastern Hemisphere. The data at present available give no indication of the region in which the opposite and compensatory variations of air mass and pressure occurred. It is hence almost certain that the period 1895-1901 was in this respect unique since the commencement of systematic observations over the Indian area in 1875.

The following conclusions follow from the preceding discussion and previous investigations:—

1st.—That there are well-marked pressure oscillations of long period over the Indian area.

2nd.—That they are directly related to the largest and most important features of the weather in India, *viz.*, the character and distribution of the precipitation of rain and snow in the Indian monsoon area.

3rd.—That they are also directly related to the great atmospheric movements over the Indo-oceanic region (*i. e.*, Southern Asia and the Indian Ocean) and neighbouring countries.

4th.—That these long period oscillations appear under ordinary conditions to be chiefly dependent upon slight fluctuations in the seasonal interchange of air between the regons north and south of the equator in the Indo-oceanic area.

5th.—That the long period oscillations and general pressure variations were unique from 1895 to 1901, and were due to more general and extensive actions which produced effects similar in character and amount in the Indo-oceanic region.

Vertical anomalies of the period in relation to cold-weather rainfall in Northern India and winter snowfall in the Western Himalayas:—The following gives a summary of the data necessary for the discussion (the complete data will be found in Tables 26 to 28 of the Appendix C):—

TABLE LXX.

Year	Mean of period, November and December.			Mean of period, January and February.			Rainfall variation in North-Western India	Character of snowfall in	
	Leh and Lahore.	Simla and Ludhiana	Quetta and Jacobabad	Leh and Lahore.	Simla and Ludhiana	Quetta and Jacobabad.		Baluchistan and Persia.	Western Himalayas.
	"	"	"	"	"	"	Inches.		
1892 .	—·009	—·032	+·006	+·087	+ 032	+·069	—1·39	Largely below the normal.	Very largely below the normal.
1893 .	— 003	—·027	+·016	—·071	—·061	—·024	+2·59	Largely above normal in Baluchistan and in large defect in Persia.	Much above the normal.

TABLE LXX—*concluded.*

YEAR.	MEAN OF PERIOD, NOVEMBER AND DECEMBER			MEAN OF PERIOD, JANUARY AND FEBRUARY.			Rainfall variation in North-Western India.	CHARACTER OF SNOWFALL IN	
	Leh and Lahore.	Simla and Ludhiana.	Quetta and Jacobabad.	Leh and Lahore.	Simla and Ludhiana.	Quetta and Jacobabad.		Baluchistan and Persia.	Western Himalayas.
	"	"	"	"	"	"	Inches.		
1894 .	—·019	—·021	—·015	—·009	—·008	+·002	+1·59	In considerable excess.	Much above the normal.
1895 .	+·036	+·006	+·003	+·029	—·013	+·013	+0·86	In moderate defect.	Much below the average.
1896 .	+·002	—·007	—·004	+·035	+·012	+·027	—0·71	In moderate defect.	Below the normal.
1897 .	?	+·015	+·040	+·003	—·001	—·009	—0·51	In moderate excess.	Normal or in slight defect.
1898 .	+·025	0	+·022	+·013	+·021	+·049	+1·50	In considerable defect.	Considerably below the normal.
1899 .	+·004	+·016	+·014	+·051	+·009	+.030	—1·06	In moderate defect.	Largely below the normal.
1900 .	—·004	—·001	—·008	+·013	+·012	+·022	+0·56	In slight excess .	Slightly above the normal.
1901 .	+·058	+·024	+·037	—·019	—·033	—·006	+1·79	In considerable defect.	In considerable local excess.
1902 .	—·011	—·004	+·013	+·064	+·034	+·060	—1·52	In large defect .	Very largely below the normal.

An examination of the available data establishes that in the years 1893 and 1894, for which the cold weather vertical anomalies were generally negative, the accompanying precipitation was in excess over the whole of the Persian region and in North-Western India, and the snowfall in the Western Himalayas was more or less largely above the normal. Also in the years 1892, 1896, 1899, and 1902, for which the cold weather vertical anomalies were positive and large in amount, the precipitation over the same areas was markedly below the normal.

The following summarizes the more important inferences:—

(*a*) In the dry season the vertical anomalies (unless small in amount) are generally of the same sign for the period November and December as for the following period January and February.

(*b*) Hence as a rule in at least two years out of three the character or sign of the anomalies in January and February can be inferred from those of November and December.

(*c*) Periods of negative anomalies (especially when large) were also periods of increased winter or cold-weather precipitation. This was very marked in the cold-weather periods of 1893 and 1894.

(*d*) Periods of positive anomalies (especially when large) were also periods of decreased precipitation, and the amount of the deficiency was roughly proportional to the magnitude of the anomalies. This relation was very marked for the years 1892, 1896, 1899 and 1902.

(*e*) There is hence a close relation between the character and magnitude of the pre-cold-weather vertical anomalies and the amount and distribution of the cold-weather precipitation.

It may be noted that similar relations were obtained in my memoir on "An account of the more important cold-weather storms in India during the years from 1876—1891," and were expressed in the following terms :—

"(1) If the vertical pressure anomalies are persistently negative throughout October to December, it is very probable the cold-weather rains (December to March) will be heavier than usual in North-Western India and the weather stormy in the Western Himalayas.

"(2) If the vertical pressure anomalies are persistently positive from October to December, it is very probable the following cold-weather rains from December to March will be light, and weather less disturbed than usual in the Western Himalayas.

"(3) Continued stormy weather during the cold weather season is almost invariably associated with a local deficiency of pressure in the middle atmospheric strata or with large negative anomalies, and the excess variation of the precipitation on the whole varies with the magnitude of the anomalies.

"(4) Unusually fine and settled weather in the months of December, January and February is almost invariably associated with excessive pressure in the middle atmospheric strata, or with what may be termed anti-cyclonic conditions at a high altitude, and the deficiency in the rainfall varies directly with the magnitude of the positive anomalies."

The experience of the unique period 1892—1902 is, on the whole, in full accordance with the above inferences based on an examination of the meteorology of the cold-weather periods of the preceding sixteen years, 1876—1891.

Hot-weather variations of pressure.—It has been pointed out in publications of the Meteorological Department that the meteorology of India is more dependent on local conditions and less dependent on conditions and actions external to India during the hot weather than in any other period of the year.

The temperature and other meteorological conditions of India in the hot weather are mainly determined by the character of the previous cold-weather season. A severe and protracted cold-weather period is almost invariably followed by cooler weather than usual in March and April, and hence in such years the hot weather conditions are less intense than the normal. On the other hand, a dry cold-weather period is generally followed by more intense hot weather conditions of higher temperature and lower humidity than usual over the greater part of the interior. Occasionally, however, dry cold weather periods are followed in March and April by disturbed weather in North-Western India, due either to frequent storms with much snow in the Western Himalayas, the result of actions or disturbances in Central Asia, or to the passage of late storms of the cold weather type across Northern India. The latter class of disturbances give light showers in the plains and late but usually moderate snow in the Himalayan region. The cold and hot weather periods of the years 1893 and 1894 belonged to the first of these classes or categories, the years 1892, 1896, 1898, 1899 and 1902 to the second, and the years 1895, 1897, 1900 and 1901 to the third.

The peculiarity in the temperature conditions in the first and third classes or categories is decreased temperature during the greater part or the whole of the hot weather period, more marked in the first class than the third, and in the second is increased temperature (the excess being usually large in amount), occasionally terminating in a period of intense heat in the latter half of May.

According to the usual explanation given in meteorological text books (probably approximately correct), increased temperature in a large area such as Northern India or the whole of India, in any of the hot weather months, gives rise to an upward expansion which disturbs the equilibrium of the air by increasing the super-incumbent mass at all elevations except at or near the earth's surface, and hence the pressure of the air. This originates an outflow above, which is followed and only partially compensated for some time afterwards by an inflow below. Hence pressure falls at the earth's surface and up to considerable heights by amounts decreasing with elevation. Above a certain height, determined by the local meteorological conditions, pressure may actually increase, due to the increase of mass above that elevation by upward expansion being greater than the decrease of mass due to outward flow.

The relative increase of pressure at considerable elevations due to this action during periods of high and increasing temperature and decreasing pressure at the earth's surface is termed "the vertical pressure anomaly for the range or difference of elevation," and is measured by the difference of the variation from the normal of two stations, one at or near the base of the hills, and the other at a known elevation in the hills.

The following table gives data of the mean variation from the normal of the pressure and temperature of North-Western India and the whole of India, during each month of the hot weather seasons of the period 1892—1902, and also the vertical anomalies of three pairs of stations, *viz.*, Quetta and Jacobabad (difference of elevation 5,316 feet), Simla and Ludhiana (difference of elevation 6,412) and Leh and Lahore (difference of elevation 10,801 feet):—

TABLE LXXI.

Year.	Month.	Variation from normal of pressure.		Variation from normal of temperature		Mean vertical pressure anomalies.		
		North West India.	Whole India.	North-West India.	Whole India	Simla. — Ludhiana (difference of elevation 6,412 feet)	Quetta. — Jacobabad (difference of elevation 5,316 feet).	Leh. — Lahore (difference of elevation 10,801 feet)
1892	March	—·083	—·074	+3·7	+1·8	+·074	+·087	+·108
	April	—·075	—·045	+6·4	+3·2	+·098	+·095	+·204
	May	—·040	—·027	+2·9	+1·8	+·049	+·050	+·125
1893	March	+·018	+·015	—2·9	—3·8	—·058	—·007	—·063
	April	—·076	—·015	+1·6	—0·5	+·011	+·056	+·074
	May	—·005	—·014	+0·1	—1·3	—·021	+·003	+·014

TABLE LXXI—*concluded.*

Year.	Month.	Variation from normal of pressure		Variation from normal of temperature.		Mean vertical pressure anomalies.		
		North-West India.	Whole India.	North-West India.	Whole India.	Simla. Ludhiana (difference of elevation 6,412 feet)	Quetta. Jacobabad (difference of elevation 5,916 feet).	Leh. Lahore (difference of elevation, 10,801 feet)
		"	"	°	°	"	"	"
1894	March	—·003	—·019	—1·1	—0·5	—·020	+·010	—·013
	April	—·027	—·021	+1·0	0	+·028	+·035	+·046
	May	—·027	—·026	+2·1	+1·5	+·042	+·037	+·082
1895	March	—·012	—·018	—0·1	—0·2	—·010	—·001	+·024
	April	—·006	+·008	+1·0	—1·1	—·013	+·034	+·012
	May	—·019	—·010	+4·3	+2·4	+·060	+·063	+·101
1896	March	—·010	—·022	+1·6	+1·6	+·017	+·017	+·005
	April	—·027	—·030	+3·0	+2·2	+·030	+·035	+·026
	May	+·003	+·010	+3·9	+2·3	+·050	+·046	+·085
1897	March	—·025	—·016	—0·8	0	+·002	—·003	—·017
	April	+·058	+·039	—0·4	+0·3	—·019	—·013	—·055
	May	—·013	—·004	+3·0	+1·7	+·054	+·050	?
1898	March	+·008	—·007	+0·5	+0·5	+·017	+·012	—·024
	April	—·027	—·013	+4·2	+2·5	+·062	+·083	+·097
	May	—·001	—·008	+0·8	+0·6	+·009	+·012	+·093
1899	March	+·004	—·003	+3·2	+1·6	+·042	+·035	+·063
	April	—·018	—·004	+1·0	—1·1	—·001	+·032	—·013
	May	—·034	—·019	+3·2	+0·8	+·047	+·043	+·075
1900	March	+·001	+·017	+4·2	+2·4	+·049	+·053	+·070
	April	+·030	+·020	—0·3	0	—·007	—·009	—·082
	May	+·065	+·056	+0·2	+0·8	+·022	—·004	—·007
1901	March	+·048	+·046	+1·9	+0·3	—·008	+·049	+·034
	April	+·003	—·002	—0·1	—0·1	—·001	+·024	—·033
	May	+·012	+·009	+1·1	+0·3	+·020	+·036	+·003
1902	March	—·021	—·013	+4·4	+2·3	+·038	+·048	+·014
	April	—·022	—·007	+2·4	+0·5	+·009	+·029	—·020
	May	—·004	+·004	+2·4	+1·2	+·025	+·042	+·039

The following are the chief results derived from an examination of the data of the preceding (Table LXXI) :—

Temperature in March was above the normal in North-Western India in seven years of the period. In only three of these years, *i.e.*, 1892, 1896 and 1902 was pressure below the normal. In the same seven years temperature was also above the normal on the mean of the whole Indian area, and pressure was in defect in five of these years.

Temperature was below the normal in four years of the period in March over North-Western India as well as the whole of India, and in only one year was the mean pressure of the area above the normal.

Hence the inverse relation between mean temperature and pressure variations in India was in March at least not the rule in the period 1892-1902. The exceptions were so numerous as to show that there were other and more general actions in play giving rise to opposite variations to those of the local temperature conditions in India.

The data for the month of April show that in eight years of the period temperature was above the normal in North-Western India and in five on the mean of the whole of India. Pressure was below the normal in the eight years in North-Western India and in four of the five years on the mean of the whole of India.

In three years temperature was in defect in North-Western India, and in the same years pressure was in excess. The inverse relation between temperature and pressure hence obtained much more frequently in April than in March, and is in fact the usual rule.

An examination of the data for the month of May indicates that temperature was in the whole of India in excess in ten years out of the eleven years of the period, and that in seven years it was accompanied with diminished pressure. In the remaining year the ordinary relation of diminished temperature and increased pressure obtained. In North-Western India temperature was in excess in every year and pressure in defect in eight years.

Hence the experience of the period 1892-1902 indicates that, with the advance of the hot weather season, the inverse relation between pressure and temperature variations obtains with increasing frequency, and hence also that the disturbing influence, due to large general actions, diminishes relatively to that of the internal or local actions due to the increasing intensity of the hot weather conditions.

The data for the periods of increased temperature in April indicate that on the mean an increase of 1° of temperature in North-Western India accompanies a reduction of pressure ·011″ below the normal, and on the average of the whole of India a decrease of ·011″ of pressure per 1° excess of temperature. The rate of decrease of pressure in North-Western India for the month of May, due to 1° excess of temperature, averages ·008″. On the average of the whole of India the relation in May is a decrease of pressure of ·011″ per 1° excess of temperature. Examination of the data of earlier years gives similar results, and hence it is very probable that an excess of 1° of temperature during the hot weather period occasions or accompanies a deficiency of pressure of about ·010″ at the level of the plains.

The following are important results of the preceding discussion :—

(1) An excess of 1° of temperature on the mean in North-Western India in the hot weather accompanies a mean deficiency of ·010″ of pressure at the earth's surface in that area, and

(2) an excess of 1° of temperature on the mean in the Indian area in the hot weather accompanies a mean deficiency of ·012″ of pressure at the earth's surface.

The number of months on which these means or inferences are based is probably sufficient to give approximately correct results.

The data in the three final columns of Table LXXI are also interesting, more especially when compared with the figures of the other columns. They indicate that when

the pressure variations in North-Western India are negative (due in part or entirely to increased temperature), the vertical anomalies are positive, and *vice versâ*, and that the magnitudes of these two sets of quantities vary proportionately. The data for the first two pairs of stations show that the vertical anomaly for pairs of stations differing in elevation from 4,000 to 6,000 feet is approximately '003" per 1,000 feet per 1° of temperature, and for 10,000 feet is slightly less, averaging '0025" per 1,000 feet per 1° of temperature. This result is also of considerable importance.

As already pointed out there are occasionally large general variations of pressure in India, which either accompany normal temperature conditions, or are not inversely related to the temperature variations. They are probably due to more general actions or causes. The most striking examples in the hot weather seasons of the period 1892-1902 are, as shown by the data of Table LXXI, the variations of March 1892, April 1897, May 1900 and March 1901.

The first two columns of the following table give data for the whole of India for these months:—

TABLE LXXII.

MONTH AND YEAR.	Variation from normal of mean daily pressure. (*a*)	Variation from normal of mean daily temperature	Probable variation of pressure due to temperature (*b*)	Probable variation of pressure due to general actions. (*a*−*b*)
	"	°	"	"
March 1892	−·074	+1·8	−·027	−·047
April 1897	+·039	+0·3	−·003	+·042
May 1900	+·051	+0·8	−·009	+·065
March 1901	+·046	+0·3	−·004	+·050

The figures in the fourth column are obtained by using the law of variation deduced from the data given in the preceding page. Allowing for the temperature variation according to that law as a correction we obtain a probable estimate of the variation due to other conditions and actions.

A similar treatment of the corresponding data for North-Western India gives similar results as shown below:—

TABLE LXXIII.

MONTH AND YEAR.	Variation from normal of mean daily pressure. (*a*)	Variation from normal of mean daily temperature.	Probable variation of pressure due to temperature. (*b*)	Probable variation of pressure due to general actions. (*a*−*b*)
	"	°	"	"
March 1892	−·083	+3·7	−·044	−·039
April 1897	+·058	−0·4	+·004	+·054
May 1900	+·065	+0·2	−·002	+·067
March 1901	+·048	+1·9	−·023	+·071

These large residual variations, not due to the local temperature variations of the Indian land area, probably represent an outflow or influx, the result of larger and general meteoro-

logical actions probably over the whole Indo-oceanic region, which have not yet been investigated but which should be thoroughly discussed.

Solar Radiation.

The intensity of solar radiation at or near the earth's surface at observatories in India is measured by a thermometer, the bulb of which is coated with lamp black and placed in an outer glass case from which the air has been partially exhausted. The instruments used for these observations are by Negretti and Zambra. They have many defects and are from various causes liable to changes of sensitivity. Hence at the Indian stations where these observations are recorded three or four instruments are exposed and occasional inter-comparisons are made. It is usually assumed that the difference between a reading of these instruments and of the standard thermometer in the shade at an observatory is a rough or approximate measure of the intensity of solar radiation that reaches the earth's surface after transmission through (and partial absorption by) the atmosphere at that place and time. If this measure could be converted into heat units, *e.g.*, calories, the difference between this quantity and the value of the solar constant at the time being, would be a measure in heat units of the loss of solar radiation by absorption in its passage through the atmosphere to that place at that instant. This determination however is not possible, as the factor of conversion is not known, and would probably vary largely with circumstances.

Solar radiation observations by means of thermometers of that type were recorded during the whole period under discussion at Madras, Calcutta, Bombay, Allahabad, Jaipur, Lahore, Dehra, Simla, Leh and Aden. Normals for those stations have also been obtained from the data of 20 to 30 years.

The following table gives the actual variations of the mean annual values of the difference of the maximum readings of the solar radiation thermometer and the maximum in the shade for the period 1890-1902 from the normal annual values for seven of these stations :—

Table LXXIV.

Station	Mean annual difference maximum solar radiation thermometer and maximum in shade thermometer	Actual annual variation of mean excess of sun over shade temperature												
		1890	1891	1892	1893	1894	1895	1896	1897	1898.	1899	1900	1901	1902
	°	°	°	°	°	°	°	°	°	°	°	°	°	
Simla . .	62·1	+1·6	+2·1	+1·8	+1·2	−0·2	+0·8	−0·2	−1·5	+0·6	+2·3	−3·6	−1·6	−3·4
Lahore .	55·0	+3·3	+2·6	+1·7	+1·2	+0·4	+0·3	+0·1	+0·3	−0·1	−1·8	−1·4	−2·9	−3·2
Allahabad .	57·6	+0·0	+0·9	−0·3	−0·1	+0·3	−0·2	+0·6	+1·1	−0·4	−0·7	−0·6	−0·4	−0·7
Calcutta (Alipore)	54·1	+2·1	+2·0	+2·4	+1·6	+1·6	+1·4	+0·3	−1·6	+0·3	−2·0	−3·6	−2·6	−2·0
Bombay	51·9	1·3	−0·2	+0·2	+0·8	+0·2	+0·5	+0·8	+0·9	−0·6	−1·3	−1·2	−0·9	−1·1
Leh . .	63·0	?	+4·8	+3·0	0	+0·9	+0·1	−0·6	0	−2·7	−0·6	−2·5	−0·6	−1·8
Aden . .	48·8	+4·0	+4·8	+3·7	+0·9	+0·2	+0·5	−2·5	−4·7	−4·5	−0·9	−2·1	+0·7	?
Mean of all stations		+2·2	+2·5	+1·8	+0·8	+0·5	+0·5	−0·2	−0·8	−1·1	−0·7	−2·2	−1·2	−2·0

In the following table are given smoothed values of the data of the preceding table obtained by the employment of the formula $\beta = \frac{a+2b+c}{4}$ —

TABLE LXXV.

Station.	Smoothed annual variation of mean excess of sun over shade temperature.										
	1891	1892	1893	1894.	1895.	1896	1897	1898	1899.	1900.	1901
	°	°	°	°	°	°	°	°	°	°	°
Simla	+1·9	+1·7	+1·0	+0·4	+0·3	−0·3	−0·7	+0·5	+0·4	−1·6	−2·5
Lahore . . .	+2·6	+1·8	+1·1	+0·6	+0·3	+0·2	+0·2	−0·4	−1·3	−1·9	−2·6
Allahabad . .	+0·6	+0·1	−0·1	+0·1	+0·1	+0·5	+0·6	−0·1	−0·6	−0·6	−0·5
Calcutta	+2·1	+2·1	+1·8	+1·6	+1·2	+0·1	−0·7	−0·8	−1·8	−3·0	−2·7
Bombay . . .	+0·3	+0·3	+0·5	+0·4	+0·5	+0·8	+0·5	−0·4	−1·1	−1·2	−1·0
Leh	?	+2·7	+1·0	+0·5	+0·1	−0·3	−0·8	1·5	−1·6	1·6	−1·4
Aden	+4·3	+3·3	+1·4	+0·5	−0·3	−2·3	−4·1	−3·7	−2·2	−1·	?
Mean of all stations . . .	+2·3	+1·7	+1·0	+0·6	+0·3	−0·2	−0·7	−0·9	−1·2	−1·6	−1·7

The curves for this element derived from the actual data will be found in Plate X and those from the smoothed data in Plate XI

The smoothed annual curves of Figs. 1, 2, 3, 5, 6 and 7 for Leh, Simla, Lahore, Calcutta, Aden (and also to a less extent Bombay) agree fairly closely in form. The chief features indicated by these curves are as follows: —

(1) A positive variation from 1891 to 1896 or 1897, the difference measuring the intensity of solar radiation being above the normal by amounts ranging from 2°·6 at Lahore to 0°·3 at Bombay at the beginning of the period and normal at the end of the period.

(2) A reduction of insolation below the normal from 1898 to 1902 or 1903, greatest in amount from 1899 to 1901, earliest at Leh and Aden, and latest at Simla and Lahore.

(3) The feature most strikingly exhibited in all the curves is the minimum usually exhibited in the year 1900 or 1901. The only station where it is very slightly shown is Allahabad, and an examination of the data appears to show that the insolation observations recorded at that station are unsatisfactory and of doubtful validity.

(4) The curve representing the mean variation for the selected stations (Fig. 8, Plate XI) shows that the mean solar radiation over India, as represented by these stations, decreased from the beginning to the end of the period. The decrease was 4° in amount or nearly 7 per cent of the mean value (55°).

(5) The Leh annual curve of the Indian stations resembles the *mean curve* (*Fig. 8*). The amplitude of variation was 4°·3.

(6) Similarly the Aden data indicate that the variation at that station was larger in amount than at the Indian stations, and that the *minimum occurred from one* to two years earlier.

The most important inference from the insolation data is that the radiation in the lowest atmospheric stratum on the mean of these seven stations from 1891 to 1902 decreased, reaching its greatest deficiency in 1899 to 1902 or the period when the atmospheric conditions, more especially decreased cloud and humidity, were less favourable than usual for absorption of the solar radiation in its passage through the atmosphere, and when, independently of variations in the emission of the energy of solar radiation, an excess of insolation might have been expected.

In order to verify further these inferences the corresponding variation data for the hot weather period, March to May, of least cloud and humidity and of the greatest elevation of the sun have been calculated for the same period, 1890-1902. The actual and smoothed data are given in the following tables, and will be found plotted in Figs. 9 to 16, Plates X and XI :—

TABLE LXXVI.

Year.	Actual variation of excess insolation temperature (mean of March, April and May).							
	Simla	Lahore.	Allahabad.	Calcutta	Bombay.	Leh.	Aden.	Mean of all stations
	°	°	°	°	°	°	°	°
1890	+0·7	+3·9	+2·1	+1·3	+2·3	?	+2·2	+2·1
1891	+1·0	+4·0	+0·7	+2·3	+1·2	?	+4·8	+2·3
1892	+4·7	−0·1	−1·7	+1·5	−1·7	+3·5	+3·6	+1·4
1893	+1·1	+1·0	+0·7	+2·0	+2·2	+2·5	+2·3	+1·7
1894	−0·9	−0·6	+0·6	+1·0	+0·5	+2·8	−0·1	+0·5
1895	−1·2	+0·1	−1·1	+1·6	+0·1	−1·9	+2·0	−0·1
1896	+0·5	−0·5	−0·1	−1·1	+1·5	+1·0	−1·7	0
1897	−2·0	+0·6	+2·1	+0·3	+1·3	−3·4	−6·0	−1·0
1898	+1·7	−0·4	−0·3	+0·2	−0·5	−4·3	−4·3	−1·1
1899	+0·8	−1·1	−0·5	−3·2	−2·4	−2·3	−0·9	−1·4
1900	+0·1	−0·5	−0·8	−2·8	−3·1	−3·8	−0·4	−1·6
1901	−1·3	−2·7	−0·1	−2·2	+0·1	−1·0	−1·9	−1·3
1902	−5·2	−4·0	−1·9	−0·7	−1·5	−2·5	?	−2·6

TABLE LXXVII.

Year.	Smoothed variation of excess insolation temperature (mean of March, April and May).							
	Simla.	Lahore.	Allahabad.	Calcutta.	Bombay.	Leh.	Aden.	Mean of all stations.
	°	°	°	°	°	°	°	°
1891	+1·9	+3·0	+0·5	+1·9	+0·8	P	+3·9	+2·0
1892	+2·9	+1·2	−0·5	+1·8	0	P	+3·6	+1·7
1893	+1·5	+0·3	+0·1	+1·6	+0·8	+2·8	+2·0	+1·3
1894	−0·5	0	+0·2	+1·4	+0·8	+1·6	+1·0	+0·7
1895	−0·7	−0·2	−0·4	+0·8	+0·6	0	+0·6	+0·1
1896	−0·6	−0·1	+0·3	−0·1	+1·1	−0·8	−1·9	−0·3
1897	−0·5	+0·1	+1·0	−0·1	+0·9	−2·5	−4·5	−0·8
1898	+0·6	−0·3	+0·3	−0·6	−0·5	−3·6	−3·9	−1·2
1899	+0·9	−0·8	−0·5	−2·3	−2·1	−3·2	−1·6	−1·4
1900	−0·1	−1·2	−0·6	−2·8	−2·1	−2·7	−0·9	−1·5
1901	−1·9	−2·5	−0·7	−2·0	−1·1	−2·1	P	−1·7

A comparison of the curves of the annual variations with those of the hot season variations indicates that the curves for all the stations, except, perhaps, Simla, correspond in their main features, more especially in the epochs of the maximum and minimum values, and also that the total amplitudes of the variation during the period are slightly greater for the hot season than for the year. This contrast of amplitude is most marked for Leh.

The only important difference between the two sets of curves is in the case of Leh. The hot season curve for Leh closely resembles that of the annual curve for Aden in the magnitude of the amplitude of variation, and early occurrence of the minimum phase.

It may be noted that these seven stations resemble each other in their very slight rainfall, and comparative absence of cloud in the hot weather period. An examination of the cloud and humidity data of Leh and Aden discloses no special local conditions determining the deep minimum at these stations immediately outside the Indian area.

There is hence evidence that the unique drought of 1899 accompanied considerable decrease of the intensity of solar radiation in the lowest atmospheric stratum, and also, considering the conditions of the period, possibly if not probably, in the higher atmospheric strata, and hence perhaps the existence of abnormal conditions in the sun. In connection with this the following extracts from a discussion on the measurements of solar radiation by means of the Angstrom Pyroheliometer at Asheville and Black Mountain N. C. in the United States Weather Review for July 1903 are of interest :—

"The deficiency in the value of Q for January, February and March 1903, as compared with the average values for these months during previous years, has been noticed by M. Henri Dufour at Lausanne, Switzerland. He is inclined to attribute it to increased absorption and reflection of radiation by the atmosphere due to the presence of volcanic dust. In a letter to him, dated July 9th, 1903, the Acting Secretary of the Smithsonian Institution says: 'The observations made here (the Astrophysical observatory at

Washington) indicate that the drop in the actinometric readings of which you speak is chiefly caused by the increased absorption of the earth's atmosphere during the present calendar year.'

"The investigation of the cause of this apparent decrease in the amount of solar radiation received at the surface of the earth (Q) calls for a special study of the absorption of the atmosphere."

Ground Surface Temperature.

The following table (Table LXXVIII) gives the actual and smoothed values of the annual variation of the ground surface temperature from the normal values (derived from 21 years' observations) at Dehra, Lahore, Jaipur, Allahabad and Calcutta for the period 1832 to 1902:—

Table LXXVIII.

Year.	Annual variation of surface temperature from the normal									
	Actual.					Smoothed				
	Dehra 1·1 feet depth.	Lahore.	Jaipur	Allahabad ½ inch depth	Calcutta	Dehra 1·1 feet depth	Lahore.	Jaipur.	Allahabad ½ inch depth.	Calcutta
	0	0	0	0	0	0	0	0	0	0
1880	..	...	.	..	−3·4	..	.	...	...	.
1881		...		−1·4	−3·1		..	...	...	−2·8
1882	+0·6	..	−1·9	−2·5	−1·5	...	...	...	−2·4	−1·8
1883	−0·3	..	−1·3	−3·1	−0·9	+0·1	.	−1·6	−2·6	−1·3
1884	+0·2	...	−1·7	−1·8	−1·7	−0·9		−1·6	−1·6	−1·3
1885	−0·8	.	−1·5	+0·2	−0·7	−0·5	..	−1·3	−0·3	−0·8
1886	−0·6	+0·8	−0·3	+0·3	−0·2	−0·6		−1·0	+0·3	−0·9
1887	−0·4	+1·1	−2·0	+0·4	−2·4	−0·5	+0·8	−1·5	+0·3	−1·3
1888	−0·7	+0·1	−1·6	0	−0·3	−0·6	+0·3	−1·4	0	−0·3
1889	−0·4	−0·3	−0·2	−0·5	+1·7	−0·3	−0·4	−0·6	−0·7	+1·2
1890	+0·4	−1·0	−0·3	−1·9	+1·8	−0·3	−0·6	−0·4	−1·7	+2·2
1891	−1·7	−0·2	−0·6	−2·5	+3·6	−0·6	−0·2	−0·4	−1·6	+3·3
1892	+0·6	+0·8	−0·1	+0·7	+4·0	−0·8	0	−0·0	−0·5	+2·4
1893	−2·5	−1·5	−1·7	−0·8	−2·1	−1·3	−0·6	−1·0	−0·1	+0·2
1894	−0·9	−0·2	−0·5	+0·6	+0·9	−1·1	−0·1	−0·4	+0·5	+0·5
1895	−0·1	+1·4	+1·2	+1·6	+2·1	+0·1	+1·0	+0·9	+1·5	+2·3
1896	+1·5	+1·2	+1·6	+2·1	+3·9	+1·0	+0·9	+1·4	+1·9	+2·7
1897	+0·9	−0·3	+1·1	+1·9	+0·7	+0·9	+0·2	+2·0	+1·5	+1·3
1898	+0·3	+0·3	+4·3	+0·1	−0·3	+0·7	0	+3·3	+0·5	+0·5
1899	+1·1	−0·2	+3·4	−0·1	+1·7	+0·7	−0·3	+2·9	+0·4	+0·9
1900	+0·3	−1·1	+0·5	+1·8	+0·3	+0·6	−0·8	+1·3	+1·6	+0·3
1901	+0·5	−0·7	+0·8	+3·0	−1·0	+0·7	−0·9	+0·8	+2·6	−1·1
1902	+1·6	−0·9	+1·2	+2·4	−2·6	...	...	...	...	...

As the data are of considerable interest they are given for the whole period, for which fairly satisfactory observations have been taken at these stations.

The actual data are plotted as curves in figures 1 to 5 of Plate XII and the smoothed data in Plate XIII.

The data and curves (Plates XII and XIII) show a fairly regular oscillatory variation throughout the period. It is most clearly exhibited by the Allahabad smoothed curve, Fig 4, Plate XIII, the epochs of the minima of which are 1883, 1891 and 1899, and of the intervening maxima 1887 and 1896. The drought year 1896 corresponds to a maximum, but the drought of 1899 to a minimum. Similarly the Calcutta curve shows a regular oscillatory variation, the chief features of which are well-marked maxima in 1891 and 1896, the former corresponding with a minimum at Allahabad, and the latter agreeing in phase with the 1896 drought epoch at that station. The minima epochs were in 1893 and perhaps 1902. The chief features in the Jaipur curve are the large maximum in 1898 and 1899, the phase being opposite in character to the phases (corresponding in time) at Allahabad and Calcutta.

The surface temperature curves for these stations present large differences, in which respect they are unlike the solar radiation or insolation curves, thus indicating that the long period variations of the ground surface temperature do not run parallel with the variations in the solar radiation which reaches the earth's surface, and are hence chiefly due to other causes.

A comparison of the ground surface temperature curves with the rainfall variation curves of the same stations (*vide* Plate VIII) shows that the former are very approximately the inverse of the latter. In other words the epochs of the critical periods agree, but the phases are opposite. Hence there is also a strong resemblance between the ground surface temperature, humidity and cloud variation curves.

The long period variations of the ground surface temperature during the period 1892-1902 were hence primarily and immediately due to the character and amount of the rainfall at each station, which also impressed or accompanied corresponding or parallel variations in other elements of observation, *e.g.*, air temperature, humidity and amount of cloud.

CONCLUDING DISCUSSION.

The period 1892-1902 was unique in the meteorology of India for the magnitude and persistence of the variations of rainfall, cloud, humidity and temperature *from the normal*.

It has been pointed out that the whole period of eleven years may be divided into two, *viz.*, a short period of three years 1892-94 characterized by general excess of rain in the Indian area, and a period of eight years, when the rainfall was on the mean of the whole of the Indian region more or less below the normal throughout practically the whole period.

The following are a few of the most important features of the period :—

A. Of the wet period or period of excessive rainfall, 1892-94—

(1) The wet period 1892-94 was unique for the general intensity of the rainfall and the exceptional excess in the more interior districts of Northern and Central India including the Punjab, Rajputana, the United Provinces and Central India.

(2) The excess was as marked in relative amount in the dry as in the wet seasons of the period.

(3) The area of general excess included, in addition to India, the following areas: Persia, Afghanistan, Baluchistan, East Africa, Abyssinia, and a large part of Australia.

(4) The period was characterized by a general excess of cloud, increased humidity and a slight reduction of temperature below the normal on the mean of each year, and, in the majority of cases, of each season of the year during the period.

(5) The excess was, relatively to the normal, greatest in the interior districts, more especially in the field of the Bombay current.

A consideration of the data of the wet period, 1892-94, indicates the following relations between the maximum annual variations of the whole Indian area for the period :—

TABLE LXXIX.

Element.	Maximum annual variation during period 1892-94.	
	From actual data.	From smoothed data.
Aqueous vapour pressure	+'013	+'009
Relative humidity	+3	+2
Cloud	+0'5	+0'4
Rainfall	+9'07	+7'43
Temperature	−1'3	−0'5

B. The following gives a similar summary of the chief features of the dry period 1895-1902 :—

(1) The rainfall in the Indian monsoon land area was more or less in defect in each year of the period. The period of deficient rain is unique in its length, as the only other period of general continued deficiency during the past 40

years was from 1864-66 and hence extended over three years only. The total average deficiency for the whole of India during the period was 24·6 inches or 60 per cent. of a normal year's supply.

(2) The rainfall was especially scanty in the years 1896 and 1899, almost continuous drought prevailing during the south-west monsoon over large areas in India during these years. The droughts in these years were followed by severe and extensive famines in the years 1897 and 1900. It is, however, not exceptional for two drought years followed by famine to occur within four years. That was the case for example in 1866 and 1869 and also in 1874, 1877, and 1878.

(3) The droughts of 1896 and 1899 and the famines of 1897 and 1900 were unique in intensity and extent of area affected. The only famine during the past 150 years comparable with those of 1897 and 1900 was that of 1869 which prevailed over practically the same area as that of 1897. The deficiency of the rainfall for the year 1899 was unique, averaging for the whole of India, by Blanford's method 11·14 inches, as compared with a previous maximum deficiency in 1868 of 6·63 inches or 27 per cent. The amount of the deficiency in the year 1896 was only exceeded in the years 1864 and 1868 during the past 40 years.

(4) The whole period was characterised by general deficiency of rain and snow in the Western Himalayas and the Afghan and Baluch mountain districts and also in Persia. The only exception was a heavy local precipitation in the East Punjab and Kumaon Himalayas in the winter of 1901.

(5) The deficiency of precipitation in the Indian area was as marked in the dry as in the wet seasons of the period.

(6) The area of deficient rainfall during the dry monsoons in the Indian monsoon area included in addition to Northern India, Baluchistan, Afghanistan, Persia, Euphrates Valley and, probably the southern regions of Central Asia (*i.e.*, Thibet).

(7) The drought also extended more or less persistently to the greater part of Australia (more especially the dry interior districts), South Africa, East and Central Africa, Abyssinia, and Mauritius. The drought area hence probably included the whole precipitation field of the south-east trades and the south-west monsoon winds, or what may be termed the Indo-Oceanic area.

(8) The field of the Bombay current was more largely affected than that of the Bay current by these variations and the interior districts more severely than the coast districts. Hence the drought in India was, on the whole, most severe and continuous in North Bombay, Central India, Rajputana, and the South Punjab.

(9) The 1896 drought was due in one part of the area affected (*viz.*, the United Provinces) to scanty rainfall throughout the whole season, and in another part (the Central Provinces and Berar) to abrupt and very early termination of the rains. The 1899 drought was due to general and unprecedented weakness of the Arabian Sea current, which gave very scanty rain throughout the whole wet monsoon.

(10) The following minor but important features were very persistent during the period :—

(1) The south-west monsoon rains were generally retarded.

(2) They terminated earlier than usual, more especially in the years 1896 in the Gangetic Plain, and in the year 1899 over the field of the Bombay current.

(3) The period of south-west monsoon rainfall was hence considerably abbreviated in most years of the period.

These features were more strongly shown in the Bombay than the Bengal current, and were most conspicuous in the Punjab, Rajputana, Central India, and the Central Provinces, where they were exhibited in six or seven out of the eight monsoons of the period.

(11) The following gives the maximum annual variations of the chief elements of observations for the whole of India during the dry period :—

TABLE LXXX.

Element.	Maximum variation during period 1893-1902.	
	From actual data.	From smoothed data.
Aqueous vapour pressure	—·026	—·015
Relative humidity	—5	—4
Cloud	—0·3	—0·2
Rainfall	—11·14	—5·61
Temperature	+1·3	+1·0

The following gives the most important conclusions from the preceding as to the character, period, extent, and intensity of the abnormal features of the period :—

An important feature of the meteorology of the period was that the larger variations of rainfall from the normal in India during the whole period were not seasonal but general, being exhibited almost as largely in the dry as in the wet monsoons. This follows first from the facts (1) that in the years of excess in 1893 and 1894 the precipitation was in excess in every season except one, and (2) that in each of the years of large deficiency in the period, *i.e.*, 1896 and 1899, the mean rainfall of the whole of India was below the normal in every season except one.

Also a reference to the data of Table XVI shows that this was not a peculiar feature of this abnormal period, but is almost certainly a general feature of Indian meteorology.

This appears to be a point of considerable importance. The abnormalities were neither seasonal or annual in character, but extended over a long period (at least 11 or 12 years), the period of excess of rainfall being three years and of deficient rainfall at least eight years.

A second important feature was the extension of the characteristic features of the first of the two periods over the whole area, including the Euphrates Valley, Persia, Afghanistan, Baluchistan, Thibet,* India, and probably Australia and South and East Africa.

* This is inferred from the data of Leh. (G. T. W.)

Similarly, the features of the second or wet period were common to the Euphrates Valley, Persia (except the northern districts), Afghanistan, Baluchistan, Thibet,* India, Australia, East and South Africa and Mauritius, and probably other islands in the Indian Ocean.

In both periods, the area affected by similarity of conditions and variations appears to have included the whole land region dependent on the Indian Ocean for its rain supply on the Indo-Oceanic region. Different portions of that vast area were similarly affected at different times or were differently affected in the same year. Thus in India it was chiefly the interior districts, more especially North Bombay, Berar, the Central Provinces, Central India, Rajputana, the United Provinces, and the Punjab, while on the other hand the coast districts suffered slightly. Again in one year it was the area usually covered by the Bombay current which was most affected, (as in 1899). In another year both fields were similarly affected as in 1896 and in a third year (*e.g.*, 1902) it was chiefly the field of the Bay of Bengal current. But the general persistent feature amidst these local variations was a persistent deficiency of rain which intensified in several years, but more especially in 1896 and 1899, into severe droughts culminating in famine over large areas. Similar features appear to have obtained in Australia and South Africa, but in these areas the drought was most intense and disastrous in 1901-02 and 1902-03. The general results were the same in all cases—much human suffering and impoverishment and great loss of cattle, reducing the general wealth of the country for some time by a considerable percentage amount. The facts hence show most clearly that the abnormalities were not special or local, but were more or less common to the whole Indo-Oceanic land and sea area throughout this period and hence the causes must have been persistent, large and general.

A third interesting feature is that the variations of temperature, humidity, and cloud during the period, were directly related to the rainfall. The cloud and humidity annual variation curves were parallel to the corresponding rainfall curves. In other words the lower air was damper and the upper air charged with a greater amount of cloud from 1892 to 1894. The opposite or inverse variation prevailed in the dry period, the years 1896 and 1899 being especially characterized by decreased cloud and lower humidity. These variations, as in the case of rainfall, were not seasonal or annual but of long period.

The variations of temperature were inverse to those of cloud, rainfall, and humidity.

Increased rainfall produces a much smaller effect on temperature in India than diminished rainfall of similar percentage amount. Temperature was in steady excess on the mean of each year from 1895 to 1902, on the mean of the whole of India and also of every month of the period almost without exception. The variation varied very little from 1° during the period and was greatest in 1896 when it was 1·2°. It is noteworthy that the 1899 drought produced a less mean increase of temperature above the normal for the whole Indian area than the 1896 drought.

The variations of these meteorological elements were hence correlated effects indicating important changes or variations in the mass of the air over India certainly and probably generally over the other land areas affected.

The data under discussion have shown that extending over a remarkable variation in the amount and distribution of the rainfall, at least 11 years affected the whole Indian

* This is inferred from the data of Leh. (G. T. W.)

oceanic area. Whether is extended over a larger area cannot, as yet, in the absence of the necessary data, be determined. The data for certain stations in Central Asia indicate that the northern limit of the area of similar variation was probably Thibet, *i.e.*, the northern limit of the mosoon circulation of Southern Asia, or the southern limit of the winter anti-cyclone of the Asiatic continent.

Over a large portion of that area, including Persia, Afghanistan, Baluchistan, and Thibet, the rainfall occurs during the winter or cold weather, the period of the dry monsoon of India and the Indian Seas. The precipitation in the peninsulas of Southern Asia, and in Abyssinia and East Africa is received chiefly during the period May to October, and is hence a hot weather rainfall. Australia, South and South-East Africa obtain their rainfall during the summer season of the southern hemisphere, and hence at the same time of the year as the winter rainfall of the Persian Plateau region.

One of the more remarkable features of the period is that the rainfall varied similarly in amount from the normal over areas of summer rainfall both north and south of the equator (at opposite periods of the year) and also over the area of winter rainfall in Southern Asia. This agreement is in accordance with experience in India, the rule being that a south-west monsoon of deficient rain, more especially in North-West India, is followed by deficient cold weather rains in the plains of Northern India and deficient winter snowfall in the plateaux of Persia, Baluchistan and Afghanistan, and in the Western Himalayan mountain region.

Rainfall is due to condensation of aqueous vapour accompanying upwards movements in a humid current. Considerable variations in the amount of rainfall over a large area served by a humid current depend upon variations in the volume, and aqueous vapour contents of the current.

It is hence necessary for the present discussion to state the normal features of the air movements or humid currents that give general rain in Southern Asia and of the abnormalities in the movements during the period 1892-1902 so far as is possible from the available data. The following is a brief statement of the normal general air movement on the Indo-Oceanic region.

The circulation of the dry season is usually fully established in the latter half of December. Over the Indian Seas the movement is from north-east towards an area of low pressure stretching across the Indian Ocean in a narrow belt immediately to the south of the equator between Lat. 8° and 12° S. To the south of this belt the air movement is from south-east extending over the sea area of the Indian Ocean as far south as Lat. 30° beyond which an anticyclonic belt lies across that ocean. Over India the movement is feeble, being from west in Northern India and east in the peninsula with variable winds over the dividing ranges at the head of the peninsula. These two semi-independent air movements feed into the low pressure belt near the equator over which they rise with probably drift towards the west. Above this area and as a continuation of the upflow, the air drifts north and south giving return movements in the middle or upper atmosphere inverse to the lower air currents. It is important to notice that these two lower air currents have a common goal, and hence that not only the position of that sink will vary to some extent with the relative strength and abnormal features of either lower movements; but also that the uptake and the outflow above giving the opposite return currents will also be affected and modified by abnormal features in the lower movements.

The period from March to May is a transition period of a peculiar character leading from the dry to the wet monsoon. Temperature increases rapidly in the interior of Arabia, India, and Burma, and pressure decreases *pari passu*, so that by the middle of March or beginning of April it has fallen below that of the neighbouring seas. Local sea winds set in over the coast districts in March and extend seawards and landwards, and also increase in intensity with the advance of the hot weather. Moderate north-east winds prevail over the Arabian Sea and Bay of Bengal in February. The north-east winds gradually decrease in strength in March and April, and light unsteady winds prevail generally in the centre of the Arabian Sea and Bay of Bengal in May. Pressure gradients increase slightly in the Indian Ocean with the decrease of temperature in the southern regions, and the belt of variable winds is gradually transferred northwards, so that it lies over the equator at the middle or end of May. The southern outflow in the middle atmosphere over the Indian area probably increases *pari passu* whilst that over the Indian Ocean decreases. At the same time there is an increasing outflow in the lower atmosphere to replace the indraught due to the sea winds blowing into India and Burma. The movement in the interior of Northern India during this period increases in strength, but is practically unchanged in direction, being from west down the Gangetic Plain and across Central India. In the peninsula it is gradually converted into an irregular cyclonic movement about the hot area in the Deccan. The air movement in India is probably more complex during this period than at any other time of the year.

The establishment of low pressure areas in the interior of the South Asian Peninsulas converts the stable pressure and wind system obtaining in the first period into an unstable system during the present period, which is finally terminated usually in the last week of May or first week of June by the suspension of the uptake over the equator and the rush or advance of the lower air movement of the south-east trades across the equator into the Indian Seas. This movement is then directed towards the low pressure areas in the interior of Burma, Northern India, South Arabia and Abyssinia, the division or distribution of the current depending upon the relative intensity of the low pressure conditions in these areas. When this movement has been established, the previous complex air movement is replaced by a single circulation extending from the South Indian Ocean to the mountain ranges of Abyssinia, South Arabia, Northern India, and Burma. This current brings up vast supplies of aqueous vapour from the oceanic area it traverses, which it discharges as rain chiefly over the land areas of Burma, India, and Abyssinia. These areas hence form the northern limit of this circulation, and the return current is from north to south at a very considerable elevation of at least 20,000 feet and probably over 30,000 feet. This movement of the south-east trades and its continuation the south-west monsoon continues in this complete form up into northern mountain barrier limits until the middle or end of September. This current from the Indian Ocean advances in part northwards over the Arabian Sea and in part over the Bay giving rise to the two great monsoon currents of Southern Asia. The air movement over the Arabian Sea (or Arabian Sea monsoon current) is in part determined to Abyssinia and Arabia and in part to the peninsula and North-Western India, whilst that over the Bay of Bengal or the Bay current passes in part into Burma and in part, after recurving due to deflection by the mountain ranges of Arakan and North-Eastern India, up the Indo-Gangetic Plain. India is hence served or receives its monsoon rainfall from both branches, whilst Abyssinia and Burma are each dependent on one branch only.

The withdrawal of the humid south-west monsoon currents occupies the next three months from October to December. The extension of the movement contracts at its northern limit and the current withdraws southwards and eastwards at the same time that its volume decreases in elevation. It first retreats from the head of the Arabian Sea, and North-Western India during the latter part of September and the first half of the month of October, and from North-Eastern India and Burma in October, the humid sea winds being replaced by north-westerly and westerly airs in Northern India which gradually increase in intensity and extension. The current in November and the first half of December recurves over the Bay, its further northward progress being barred by the high pressure conditions now established in Northern India. The recurving current hence advances to the Madras Coast from the north-east and east and gives frequent rain during the period, the period of most general rain in the Coromandel Coast districts.

The area of the current continues to contract and its northward limit is slowly transferred southwards until it passes out of the Bay in December. Similar changes occur *pari passu* in the Arabian Sea, but somewhat earlier than in the Bay. North-east land winds, the continuation of the dry land winds now established in India, gradually extend over the Indian seas during the period, and usually before the end of December have advanced southwards to the equator, and the double circulation with a trough of absorption in the equatorial belt is re-established. The transformation of the double circulation (in June) is a rapid process due to impulsive action. The reverse change is a comparatively slow process occupying nearly three months.

If the data of the preceding sketch be correct, it follows that the currents, condensation of aqueous vapour in which gives rain to India in both the dry and wet seasons, are humid currents from the Indian Ocean. In the wet season the humid current is a lower horizontal movement extending upwards to a very considerable elevation. In the dry season it is an upper current from the neighbourhood of the equatorial belt, being the return current of the lower land air movement. As this upper current is due to an uptake marking the limits of the strong south-east trades as well as of the north-east monsoon winds, it is possible, if not probable, that any large special features characterizing the south-east trades (and hence the south-west monsoon winds) might be continued during the dry or north-east monsoon, in the upper movement. It is apparently due to this possible continuity of action and characteristics that the rainfall of the dry season in the Persian Plateau and Northern India is as a rule similar in its variation to that of the preceeding south-west monsoon, and hence also that the variations of the unique period 1892-1902 were general and common to the whole year, and were but little marked by seasonal differences. The exceptions to this in India were chiefly in the hot weather season when the rainfall depends almost exclusively upon local actions, and not upon actions or conditions common to the whole or large part of the Indo-Oceanic area. This appears to me the only explanation suggested by the data of one of the more important features of the rainfall of the period in India, Burma and the Persian Plateau (*i. e.*, Persia, Afghanistan, and Baluchistan), *viz.*, that the variations of the rainfall in the wet and dry seasons were the same in character and similar in amount relatively to the normal.

The statement of the air movement in the Indo-Oceanic region also suggests the more important abnormal variations in the humid currents which may modify the distribution of the south-west monsoon rainfall in the peninsulas of Southern Asia.

It is, for example, possible that the south-east trades winds may be determined to South or Central, Africa to an unusual extent and for prolonged periods—in fact during the whole or the greater part of the south-west monsoon period. If this be the case, a smaller volume of the humid current will pass across the equator into the Indian seas, and the rainfall of the South Asian Peninsulas will be more or less reduced. The available information indicates that this was the case in 1896. The rainfall in South and South-East Africa in that year was continued from the summer over the following autumn and winter months, in fact until July or August (*vide* Mr. Hutchins' account, page 246). It is possible that in this case the excess of rainfall in South Africa may compensate for the deficiency in India and Abyssinia.

Again the lower movement of the south-east trades circulation in the Indian Ocean may be feebler than usual. This may accompany feebler gradients in the Indian Ocean produced either by reduced pressure in the permanent anticyclone of the South Indian Ocean or by its displacement further south than usual. Practically no exact information is available in India for showing whether either of these conditions when it occurs is due to temporary extension of the permanent ice barrier in the South Antarctic regions or to the presence of icebergs to an unusual extent and up to limits considerably further north than usual. Some data which were received from the London Ship Masters' Society show that during a portion of the period there was an unusual extension of icebergs northwards from the antarctic regions, to such an extent as to make it necessary to modify the course usually prescribed for steamers proceeding from England to New Zealand.

General weakness in the south-east trades would evidently give rise to the following features :—

1st.—Delay in the advance of the trades across the equator.

2nd.—Less volume of humid winds giving rainfall to the peninsulas of Southern Asia.

3rd.—Early withdrawal of the humid south-west monsoon currents from the India region.

These features were all present to a very marked extent in 1899, and led to the severe drought of that year followed by the intense famine of 1900. They were also exhibited, but to a less extent, in the years 1900, 1901, 1902, and slightly in the years 1903 and 1904.

The continuation current of the south-east trades, *i.e.*, the south-west monsoon current, is determined to three areas, *viz.*, Abyssinia, India, and Burma. It is evident that the current will advance in different amounts or volumes in different years. The division of the current and accompanying rainfall will depend upon the relative pressure conditions established during the hot weather. An area of great deficiency of pressure will not only determine a large influx but in virtue of the rainfall continuing for more or less prolonged periods in such areas will probably continue to obtain more than its proportionate share of rainfall. This opposition between the rainfall of the three competing areas is well marked. For example the monsoon rainfall of Burma varies as a rule similarly to that of the adjacent districts of Assam, Bengal, and Orissa, more especially Assam, East and South Bengal, and generally inversely to the precipitation in North-Western, Western, and Central India. On the other hand, the rainfall of Abyssinia appears generally to follow the same law of variation as that of Western India. Rainfall data of Abyssinia for

the period are not available, but the heights or the Nile Floods in August and September, which are chiefly due to rainfall in Abyssinia, agree generally in character with that of the rainfall in the field of the Bombay current.

During the period 1895-1902, as already stated, the Bay current was apparently less adversely affected than the Bombay current and was determined in larger proportion than usual to Burma, in accordance with the general relation that in years of weak monsoon currents the coast districts suffer to a much less extent than the interior districts.

The following gives a statement showing the contrast between the rainfall in Burma and India during the whole period 1892-1902 :—

TABLE LXXXI.

Year.	Variation of Rainfall (June to October) from Normal.			
	Actual.		Percentage.	
	India.	Burma.	India.	Burma.
	"	"		
1892	+3·73	+0·11	+9	0
1893	+4·11	−2·18	+12	−2
1894	+7·41	+15·39	+19	+13
1895	−1·93	−16·33	−6	−15
1896	−4·93	+17·39	−11	+17
1897	+2·71	+1·03	+6	+1
1898	+1·44	−3·27	+3	−3
1899	−6·61	−3·14	−16	−3
1900	+0·21	+5·18	+1	+5
1901	−5·46	−4·18	−13	−4
1902	−1·20	−3·27	−3	−3

Finally, the relative distribution of the rainfall in any one of the three competing areas may vary very largely from the mean owing to local conditions. Large local variations are probably more marked and frequent in India, than in Burma or Abyssinia. Abnormally strong or weak monsoons in India affect the interior districts much more largely than the coast districts, the positive or negative percentage variations from the normal as a rule increasing from the coast districts to the interior. The variations are generally largest in the Punjab, Rajputana, Central India, the western districts of the United Provinces, the West and Central Deccan, the Peninsula and Central Burma. These are in fact the areas most liable to drought leading to famine.

Again, Blanford established that heavy and prolonged winter snowfall in the Western Himalayas was accompanied and followed by temperature and pressure conditions in North-Western India such as are usually associated with delay in the advance of the Bombay branch of the monsoon currents and with more or less severe drought over a part or the whole of North-Western India. The last example of this was in 1891. The snowfall

of the winter 1890-91 was not only excessive in amount but continued abnormally late and lasted until May. As a result there was severe drought in the greater part of Rajputana and part of the Punjab followed by famine of considerable intensity.

As the winter snowfall was in general defect in the Persian Plateau and Western Himalayas in each winter of the period 1895-1902, there was during that period no example of the importance of the heavy winter snowfall factor.

The following gives a very brief sketch of the air movement in the south-east trades region and the equatorial belt in the years 1893, 1896, 1897, 1899, 1900, and 1902 based on the meteorological data obtained from vessels entering the ports of Calcutta and Bombay.

1893. *May.*—At the commencement of the month the trades had not advanced beyond Lat. 5° S. They crossed the equator in the last week of the month.

June.—Strong steady south-east trade winds prevailed throughout the month.

July.—Strong steady winds normal in direction prevailed over the western half of the equatorial belt and the entrance to the Arabian Sea. They were weaker than usual in the eastern half and their mean direction was more westerly than usual.

August.—Winds were of normal strength in the western half of the equatorial belt except between the 13th and 20th. They were also more easterly than usual. They were apparently normal in character in the eastern half.

September.—Winds were normal in direction but stronger than usual in the equatorial belt and the extreme south of the Arabian Sea and Bay of Bengal. They fell off rapidly in the third week of the month and were light and unsteady in the fourth week.

1896. *May.*—The south-east trades did not advance beyond Lat. 3° S. until the 21st. They extended across the equator in the last week of the month.

June.—Winds were weak in the equatorial belt (western half) until the 6th when they increased, and were moderately strong during the remainder of the month.

July—Moderate to strong winds obtained in the equatorial belt during the month.

August.—The air movement was somewhat feebler than usual, more especially from the 10th to the 22nd when very light winds prevailed over the whole of the western and central portions of the belt.

September.—Moderate winds prevailed in the belt from the 1st to the 8th, and again from the 23rd to the 30th. Winds were very feeble and irregular from the 9th to the 22nd.

1898. *May.*—The south-east trades horizontal movement was restricted to the south of the equator during the month.

June.—The advance of the trades winds across the equator occurred in the first week of the month and moderate to strong winds prevailed in the equatorial belt until the 20th. Winds were very weak and unsteady during the remainder of the month.

July.—The lower movement across the equator was generally feeble and considerably below the normal, more especially from the 10th to the 20th, when light airs and calms prevailed.

August.—Moderate to strong steady winds prevailed throughout the month.

September.—Steady normal winds of moderate strength obtained during nearly the whole month.

1899. *May.*—South-east winds did not advance beyond Lat. 4° S. until the end of the month. Feeble unsteady winds hence prevailed throughout the month over the equatorial belt.

June.—Winds were more unsteady than usual, more especially in force. The south-east trades movement was continued across the equator in the first week of the month, but the advance was not so strong as usual.

July.—Winds were very feeble throughout the month in the centre of the equatorial belt and were also very unsteady and variable, more especially in the second half of the month. In the western part of the belt winds were of moderate strength during the first fortnight and were much feebler than usual in the second half. They were much more southerly than usual from the 2nd to the 12th and more easterly or less westerly during the remainder of the month, the variations being rather large and persistent.

August.—Winds were very light and irregular in the centre of the belt throughout the month. They were strong but very unsteady and frequently abnormal in direction in the western portion.

September.—The air movement was similar to that of August with the exception that it was feebler more especially in the western half.

1900. *May.*—The advance of the south-east trades across the equator was delayed until the first week of June. Winds were very weak and unsteady in the equatorial belt during the whole month.

June.—Winds were of moderate strength during the month. They increased to some extent in the last week of the month.

July.—Fairly strong and steady winds prevailed in the western half of the belt during the month. Winds were more easterly than usual during the last fortnight in the region to the south of the equator.

August.—Moderate to strong winds normal in direction prevailed throughout the month.

September.—Winds were almost as steady and strong in the equatorial belt as in August.

1902. *May.*—During the first half of the month strong south-east trades were blowing south of the equator and were continued into the south-west of the Arabian Sea off the African coast. Winds in these areas then fell off rapidly and were feeble during the remainder of the month but began to increase rapidly at the end of the month.

June.—Strong southerly winds prevailed in the western half of the belt and extended northwards over the Arabian Sea during the first week of the month. Winds decreased considerably in force on the 15th and following days and were much below their normal strength until nearly the end of the month.

July.—Winds were normal in direction and slightly below their mean strength on the average of the month. They were fairly steady throughout.

August.—Winds were apparently very abnormal in force and direction during the month in the western half of the equatorial belt. They were largely determined to East Africa in the first week of the month and were much feebler than usual and from northerly directions in the second week of the month. Winds reverted to their normal direction and strength from the 17th to the 26th, but were light and unsteady during the remainder of the month.

September.—The air movement in the equatorial belt was weaker than usual from the 1st to the 11th and the 24th to the 29th, and normal in the intervening period.

The following tables give the mean intensity of the air movement in the equatorial

belt during the south-west monsoon period for 1892-1902. The means are based on the information collected by the Calcutta and Bombay Meteorological Offices from vessels entering the ports of Calcutta and Bombay. The data thus collected usually give a fairly correct estimate of the mean monthly wind force, but occasionally when the number of vessels from which data are obtained is small the means are of doubtful value. The data must hence be regarded as a first rough approximation only. It may be premised that the equatorial belt considered includes the region between the 8th parallel of south latitude and the 4th parallel of north latitude. The meridian of 76° E. divides it into a western and an eastern half.

TABLE LXXXII.

Month.	Mean monthly wind force (Beaufort's notation) at 8 A.M. in the western half of the equatorial belt.										
	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	Mean of ten years.
May	2·7	2·9	2·6	2·8	3·2	3·2	2·8	2·8	2 8	3·3	2·9
June	3·6	3·1	4·1	4·1	3·3	3·5	3·9	3 7	3·5	3·6	3·6
July	4·2	3·5	4·0	3·7	3·2	3·6	4·0	3·8	3·7	3·5	3·7
August	3·6	3·0	3·5	3·7	3·7	3·8	3·7	4·0	3·3	3·5	3·6
September	2·9	2·9	3·5	3 4	3 3	3·3	3·3	3·5	3·6	3·5	3·3
Mean (May to September)	3·4	3·1	3·5	3·5	3·3	3·5	3·5	3·6	3·4	3·5	3·4

TABLE LXXXIII.

Month.	Mean monthly wind force (Beaufort's notation) at 8 A.M. in the eastern half of the equatorial belt.										
	1893	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	Mean of ten years.
May	2·9	2·7	2·2	2·8	2·6	3·0	2·6	2·7	2·5	2·9	2·7
June	3·0	3·0	2·3	3·3	2·6	2·7	2·7	2·9	2·8	2·5	2·8
July	3·3	2·9	3·0	3·1	2·5	2·4	3·0	2·9	3·1	2·6	2·9
August	3 6	3·2	2·8	2·7	3·1	2·6	2·9	3·0	2·6	3·0	3·0
September	2·5	2·8	2·9	2·9	2·9	2·5	3·3	3·1	2 6	2·4	2·8
Mean (May to September)	3·1	2·9	2·6	3·0	2·7	2·6	2·9	2·9	2·	2·7	2·8

TABLE LXXXIV.

Month.	Percentage of wind steadiness in the western half of the equatorial belt.										
	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	Mean of ten years.
May	35	65	23	59	45	47	58	20	40	45	44
June	71	71	85	66	71	67	59	58	61	59	67
July	59	66	72	72	67	68	71	75	54	66	67
August	82	59	67	78	81	74	72	77	62	51	70
September	52	39	68	59	61	56	61	67	38	68	57
Mean (May to September)	60	60	63	67	65	62	64	59	51	58	61

TABLE LXXXV.

Month.	Percentage of wind steadiness in the eastern half of the equatorial belt.										
	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	Mean of ten years.
May	53	28	47	61	35	80	45	35	30	30	44
June	61	41	30	32	24	100	63	9	43	47	45
July	46	24	45	51	23	100	47	22	32	48	44
August	51	38	42	60	24	80	66	46	28	30	47
September	36	17	31	24	74	24	70	49	42	9	38
Mean (May to September)	49	30	39	46	36	77	58	32	35	33	44

The preceding data show that in the year 1893 of large excess of rainfall in India strong steady winds prevailed throughout the period May to September, and the mean wind force for the period as shown by Tables LXXXII to LXXXIV was above the normal throughout the whole extent of the belt. The year was probably typical of the conditions obtaining in the North Indian Ocean and Equatorial Belt in a year of favourable and abundant rain in India.

The years 1896 and 1899 were marked by large deficiency of rainfall. The 8 A.M. air movement in the Equatorial Belt differed little from the normal in steadiness or strength in the monsoons of 1896 or 1899 according to the data of Tables LXXXII—LXXXV.

The account of the winds derived from the ship observations, on the other hand, indicates that in the western half of the Equatorial belt the movement was much weaker than usual in these two years, and was also very unsteady in amount or intensity (although not in direction). The year 1899 was typical of a minimum of very deficient rain in India.

In 1902 the monsoon rainfall was considerably below the normal, but to a less extent than in 1896 and 1899. The air movement in the equatorial belt was, on the average of the season, slightly below normal strength and steadiness. The full information shows that it was very abnormal in direction in August.

The years 1897 and 1900 were similar in this respect that they were years of recovery from the effects of the droughts of the previous years. In both years winds were very unsteady and variable in the eastern half of the belt in May, June, and July and were somewhat more unsteady in June in the western half. They were, on the other hand, steadier and stronger in both years in August and September, the months when well-distributed rain in India is most effective and valuable for cultivation. The rains were delayed for some time in both years but were satisfactory and favourable and practically terminated the effects of the droughts of the two preceding years.

The data hence on the whole show a fairly well defined relation between the larger variations of the monsoon rainfall in India and the air movement in the Equatorial belt during the same period and hence probably in the south-east trades region generally. They all show that there were large and important variations in that movement during the period 1895-1902 of deficient rainfall in India.

The only meteorological station in the Equatorial belt is that of the Seychelles which was established in 1893, under the direction of the Port Officer. It has unfortunately never been inspected by an officer of this department but so far as can be judged from frequent examination of the observations they were accurately taken. The Port Officer takes much interest in the work of the observatory. The exposure of the wind instruments is probably fairly satisfactory. The observations are of great interest and show most clearly the large and abrupt increase of the air movement when the south-east trades winds burst across the Equator. The following gives weekly data for each year of the period 1894 to 1902 from the beginning of May to the last week of September:—

TABLE LXXXVI

WEEK.	HOURLY WIND VELOCITY IN MILES AT THE SEYCHELLES.							
	1902	1901.	1900	1899	1898	1897.	1896	1895.
1st to 7th May	7·3	6·0	4·9	5·7	3·1	7·1	5·3	5·9
8th to 14th „	6·5	4·7	6·3	4·4	2·4	6·4	8·3	3·6
15th to 21st „	7·7	3·0	3·4	7·5	7·9	6·2	10·1	3·7
22nd to 28th „	13·9	9·8	5·4	19·5	7·5	6·9	9·4	6·4
29th May to 4th June	12·2	8·4	8·8	10·9	7·5	4·5	9·4	9·9
5th to 11th June	13·4	11·5	9·6	8·3	10·8	7·3	9·5	12·9
12th to 18th „	8·9	7·0	9·8	12·2	13·7	7·8	11·8	11·6
19th to 25th „	8·6	8·3	8·9	13·5	10·3	9·0	9·9	10·3
26th June to 2nd July	11·1	7·8	11·3	11·7	13·0	4·0	10·7	13·0
3rd to 9th July	9·5	9·4	9·8	15·9	13·9	11·3	12·6	9·7
10th to 16th „	9·4	7·1	13·9	14·8	12·2	10·0	11·9	11·3
17th to 23rd „	10·6	11·0	11·3	13·3	8·9	9·2	12·6	14·0
24th to 30th „	15·3	12·9	12·4	14·8	11·5	16·8	11·3	11·2
31st July to 6th August	11·8	11·5	12·9	13·0	12·4	11·5	15·8	13·2
7th to 13th „	10·2	15·0	13·8	14·2	12·3	9·9	14·0	11·7
14th to 20th „	15·7	15·7	15·5	15·3	14·3	13·1	13·7	16·0
21st to 27th „	11·5	15·8	14·7	15·8	12·3	12·8	15·5	14·0
28th August to 3rd September	12·2	17·2	12·2	12·2	9·9	8·9	16·1	12·0
4th to 10th September	14·1	15·3	10·7	15·0	13·4	16·7	10·8	13·3
11th to 17th „	13·4	12·5	11·5	12·8	12·5	10·9	13·3	12·9
18th to 24th „	8·9	8·6	14·3	11·7	10·3	13·0	12·8	12·1

Amongst the more interesting features indicated by the data are the following:—

(1) The prolonged delay in the advent of the strong winds in 1897, 1900, 1901, and 1902, in each of which years there was a considerable retardation in the setting in of the south-west monsoon rains.

(2) The change occurred about the normal date in 1895, 1898 and 1899.

(3) The most remarkable feature is the fairly uniform strength of the winds in the years 1896 and 1899 of drought in India.

The Seychelles wind data hence appear to indicate that the lower air movement was normal in that part of the Equatorial belt in which it is situated during the drought years of 1896 and 1899 in India.

This is confirmed by the following mean monthly data for the same period :—

TABLE LXXXVII.

YEAR.	WIND VELOCITY IN MILES PER DIEM.					
	May.	June.	July.	August.	September.	Mean of period, May to September.
1894	196	301	290	284	277	270
1895	121	287	279	328	297	262
1896	202	247	292	357	301	280
1897	151	170	264	272	304	232
1898	133	272	275	303	275	252
1899	180	271	348	336	273	282
1900	128	230	286	329	288	252
1901	142	214	240	353	293	249
1902	221	264	267	292	291	267
Mean of nine years	164	251	282	317	289	261

The same conclusions follow from this as from the data of the preceding table. The following gives data of the wind steadiness, expressed as percentages, of Seychelles for the same period :—

TABLE LXXXVIII.

YEAR.	PERCENTAGE STEADINESS OF WIND DIRECTION.					
	May.	June.	July.	August.	September.	Mean of period.
1894	71	89	82	88	94	85
1895	14	68	89	92	95	72
1896	92	84	89	93	53	82
1897	63	65	81	87	92	78
1898	40	84	82	90	85	76
1899	79	87	97	90	82	87
1900	40	87	95	95	92	82
1901	56	73	81	92	87	78
1902	68	82	77	85	89	80
Mean of nine years	58	80	86	90	86	80

The air movement at and near the Seychelles is strongest and steadiest in August. The data of the last table show the great steadiness of the winds at that station throughout the period and the rapid increase which occurs in the latter part of May and beginning of June. They also establish that the air movement in the neighbourhood of the Seychelles was not only stronger but also steadier than usual in the great drought years of 1896 and 1899.

The question as to whether this feature was local or general to the western half of the belt is in part answered by the discussion of the means determined from the marine data.

An examination of the winds during the period of breaks in the rains in India, of which there were fourteen well-defined cases during the eight-year period 1895-1902, suggests (1) that the winds are almost invariably steadier than usual during these breaks, and (2) that in seven cases out of ten they were below normal strength.

The element of observation most directly related to air movement is pressure. The measurement of wind direction and velocity as made at meteorological observatories is far from exact or satisfactory, whereas that of air pressure is capable of the greatest accuracy. These facts suggest that possibly the more important normal and abnormal features of the larger air movements may be more clearly and exactly revealed by the pressure changes and variations than by the direct wind observations.

The pressure changes in the Equatorial belt are always very small in amount. The annual variation, as determined from the monthly mean, is, for example, no larger than the mean diurnal range of pressure. The seasonal changes increase in amount northwards and southwards, so that in Lat. 30° the annual variation determined from monthly means is at least five times as great as at the Equator. In Central Asia the range is very large due to cyclonic pressure conditions in summer and excessive anticyclonic conditions accompanying extreme winter cold. The large annual changes of pressure in the Indo-Oceanic area imply a balance of transfer of air to areas in which pressure is increasing and an outflow from regions in which it is decreasing. This is, in part at least, if not chiefly, effected by a slow transfer of air mass in the middle or upper atmosphere over the Indo-Oceanic region between the north and south of the Equator. The movement effecting this mass transfer is not directly observable in India in part, because it is a comparatively slow adjustment, and in part because it apparently does not occur in the region of cirrus cloud.

It is certain that this movement will vary to some extent from season to season and year to year. Hence the unbalanced seasonal transfer may be sometimes in excess and sometimes in defect of the mean transfer (indicated by the mean annual pressure changes). In each of these cases there will be a slight excess of pressure in one region and a corresponding defect in the second region due to variation in the amount of the superincumbent air mass. This contrast between the long period variations of the regions north and south of the Equator was clearly exhibited during the period 1876-1892 as may be seen by comparing the curves Plates XX and XXI for India and Mauritius in my *Memoir* on "A preliminary discussion of certain oscillatory changes of pressure of long period and of short period in India." The epochs are practically simultaneous and the variations inverse in phase. The same opposition was shown very clearly in the year 1893. In that year pressure was in marked defect to the south of the Equator, more especially in

Australia and Mauritius. It was, on the other hand, in general excess not only in India and Burma, but also in China (as evidenced by the data for Hongkong and Zikawei), and in Persia and Baluchistan as is shown by the data for Bushire, Baghdad, and Quetta.

If these long period variations were due to the causes assigned, or to similar actions, it is certain that similar variations would continue to be exhibited in the period 1895-1902. The Mauritius curves for this period are, however, not the inverse of the Indian curves. This suggests that some additional general action affected pressure similarly over the whole area and obscured more or less completely the ordinary long period variations which were in progress due to the annual monsoon transfer.

The recent researches of Sir Norman and Dr. Lockyer appear to indicate the existence of a slight residual transfer, perhaps of long period, between the eastern or continental hemisphere and the western or oceanic hemisphere. It is, however, doubtful whether this will explain the anomalous pressure conditions in the Indian oceanic region in 1895-1902.

A comparison of the pressure data and curves (Plates XX, XXI, and XXII) plotted from the data given in Tables LXV, LXVI, LXVIII, LXIX, and 29 of Appendix C, show that on the mean of the year 1896 pressure was in slight excess over the area represented by the following stations: Cape Town, Adelaide, Mauritius, Singapore, Batavia, Hongkong, Zikawei, Bushire, and Baghdad, and was normal at Perth and at the Indian stations generally, and was in excess over a very large part of the Indo-Oceanic region. The excess was small in amount, but it is none the less significant on this account as it indicates the presence of more general actions than those of the annual transfer of air between the atmospheric regions north and south of the Equator. Again the mean pressure of the year 1898 was in marked defect over the same area. The deficiency was as large in China and India as in Australia.

The occasional marked parallelism between the pressure variations over the whole of the Indo-Oceanic area during the period 1895-1902 is a most important fact. It indicates the play of more general actions in the Indo-Oceanic area than those giving rise to the semi-annual transfer between the regions north and south of the Equator, actions which were sufficiently powerful to obscure the effects of the ordinary actions. It is possible that the full interpretation of these pressure variations in terms of the amount and character of the corresponding air movement might, in part at least, solve the problem of the large variations of rainfall during the period.

The decrease of pressure in the hot weather period is a direct thermal effect. This reaches its maximum influence in the last week of May or first week of June, after which the invasion of India by the monsoon current produces a large decrease of daily range of temperature and a moderate reduction of mean temperature. Pressure, notwithstanding, decreases to some extent in June and July, and the lowest monthly pressures of the year in India occur in June and July and the absolute minima pressures during the cyclonic storms of the monsoon period, the chief feature of which is heavy rain. It is hence evident that the heavy rain during the monsoon is even more effective in reducing pressure locally than the great heat of the hot weather. In other words, the release of energy during the condensation of aqueous vapour and its absorption by the atmosphere give rise to pressure effects which are similar to those of the direct heating action of the sun, but may be much larger in amount and more local in their extension. That a deficiency

of rainfall over a large part of India is accompanied with an excess of pressure is seen by a reference to the curves representing the long period variations of India in the period 1892-1902. There was for instance a marked excess of pressure (local and not due to a long period variation) in the monsoon periods of the years 1896, 1899 and 1902, and a similar small to moderate deficiency in the monsoon periods of the years 1893 and 1894. Blanford has shown that heavy winter snowfall in the Western Himalayas modifies the pressure conditions to a marked degree.

The preceding remarks have indicated that some of the abnormal pressure features in the Indo-Oceanic region were unique and also affected the whole area in similar manner, so that they were due to some very general actions. The accompanying air movement must, as a rule, have exhibited corresponding variations, in part shown by the very limited data available for nearly the whole oceanic area of the Indo-oceanic region.

The investigation has hence indicated the presence of abnormal large or well-marked features of rainfall, air pressure and probably air movement in the Indo-Oceanic area which were more or less persistent for a long period. It would be very desirable to assign the primary cause of these large persistent variations.

A simple and adequate explanation undoubtedly would be afforded by variations in the intensity of solar radiation either generally or in the lower atmosphere due to larger absorption than usual in the upper and middle atmosphere: the decrease in solar radiant energy would diminish the supplies of aqueous vapour and hence probably also of precipitation.

The only data available in India for discussing this point are the insolation observations made by means of black bulb in vacuo solar radiation thermometers. Data have been given for the largest and most important observatories where the conditions for accurate observations are most satisfactory. The mean data (given in pages 283 and 284 and plotted in Plates X and XI) agree very closely and establish that there was an apparent increase or excess over the mean of solar radiant energy in the lower atmosphere before and during the wet period (1891 to 1894) and that there was on the other hand a deficiency during the greater part of the dry period and more especially from 1900 to 1903. Increased radiation in the lower atmosphere over the tropical Indian Ocean would undoubtedly tend to give more abundant supplies of aqueous vapour and decreased radiation diminished supplies.

The solar radiation thermometer in ordinary use in India and elsewhere has numerous effects and its observations are hence not satisfactory and require to be most carefully and critically examined before any conclusion based on them can be accepted. Unfortunately results of the measurement of solar radiation are not regularly published apparently because there is no general agreement as to a suitable instrument for ordinary observations. Statements have been given in recent monthly weather reviews of the Washington Weather Bureau and elsewhere which seem to confirm the data of the India solar radiation instruments. For example, it is stated that the value of the solar radiant energy at a continental observatory in 1902 was lower than usual, and it was suggested this was due to an usually large amount of dust in the upper atmosphere, a result of the Mount Pelée emptions. Again it was noted that low values of the solar constant were observed in 1903 at the Alleghany astrophysical observatory, and it was inferred that the heating power of solar radiant energy was unusually below the normal. The conclusions from the data

available to me at present are more or less doubtful due to the unsatisfactory character of the solar radiation thermometer. It is most desirable that this feature of observations should be examined and discussed as fully as possible from all the available observations.

It is not the object of the present memoir to give an adequate or complete statement of the facts of the large abnormal features of the meteorology of the Indo-Oceanic area during the unique period, 1892-1902, for it is not possible under present arrangements to collect all the data necessary for such a statement. Neither is it attempted to give a satisfactory and conclusive investigation of the primary causes or actions giving rise to these abnormal features. This cannot be effected owing to the scanty amount and unsatisfactory character of the actual data of the variations of the large air circulation in the Indo-Oceanic area and of solar radiation in India during the period.

The main object of the memoir is to direct attention to the more important facts of the meteorology of the Indian land area during the past eleven years, and to indicate that it is absolutely necessary in order to ascertain the causes of these and similar large variations to study the meteorology of the whole Indo-Oceanic field. This must be carried out systematically and continuously if the problems suggested by the facts of the past eleven years are to be solved. When this has been done, seasonal forecasting in India will become much simpler and more certain than during the past eleven years. It may be necessary to go further afield, but the need for this can only be shown as a result of the extension suggested.

G. . C. P. O.—No. 859 Meteo.—27-3-05—425.

APPENDIX A.

Famine of 1896-97.—The crops in 1896 are known to have failed very seriously over large areas, and elsewhere were below the average. There was thus a strong probability that the production of the year was much below the requirements of the population. Yet, with the exception of 600,000 tons of Burma rice, there was no import of food grains from abroad, and there was no absolute dearth of food, and it was always purchaseable, though dear. Accumulated stocks must, therefore, have been in existence, and have made good the deficiency in the year's output. The amount of deficiency cannot be quantitatively stated. All that can here be done is to indicate approximately, by examination of the effect of the drought on the harvests of each province, the extent to which the year's outturn appears to have been below that of ordinary years.

In the Punjab the aggregate yield of the autumn and the spring harvests of 1896-97 seems to have been about 25 per cent. or 30 per cent. short of an average crop. In some districts the deficiency was very much greater, and in others less than this. Considering the scanty rainfall of the year the result was highly satisfactory, and it could not have been attained were it not that the province is exceptionally well equipped with canals and wells and its agriculturists willing and able to make the fullest use of them. No less than 40 per cent. of the rain crop area and 50 per cent. of the spring crop of 1896-97 was irrigated—percentages higher than have ever been known before. The food grain production of the Punjab is in normal seasons considerably in excess of its requirements. Taking into account the economy in consumption enforced by high prices, the yield of 1896-97, though below the average, probably represented one year's food supply for the province. The food stocks in existence in the province at the beginning of the drought have been estimated to represent seven months' further supply. Thus the Punjab, as a whole, was very fortunately situated. Local deficiencies of food stocks, as in the district of Hissar, were easily made good by importations from the less affected districts, and grain was also steadily sent out of the province to the North-Western Provinces and the Central Provinces.

The *North-Western Provinces and Oudh* were less fortunately situated. These provinces, owing to their dense population, are not credited with producing a large surplus of food even in ordinarily good years. In 1896-97 the autumn crop, as a whole, was fully 50 per cent., and the spring crop 33 per cent. below the average. Taking the two crops together the province may be considered to have lost two-fifths of its ordinary harvest outturn. The loss would have been very much greater but for the splendid canal systems which traverse the western and central portions of the North-Western Provinces, under the names of the Eastern Jumna Canal, the Agra Canal, and the Ganges Canal, and for the innumerable wells and ponds which stud the face of the country, especially in Eastern and Southern Oudh, and in the eastern districts of the North Western Provinces. The canals irrigated 3,000,000 acres in the two harvests of 1896-97, The area irrigated by wells and tanks has not yet been returned, but it may be safely said that in very few districts did the spring crops yield much, except on irrigated lands. To irrigation therefore the very fair results of the spring harvest of 1897 must be ascribed. The efforts made by the cultivators to utilize to the fullest possible extent every drop of water and to raise a crop were described by observers as heroic. Still the deficiency in the food production of the year was large. Stocks seem to have been low owing to preceding bad seasons. The statistics of railway traffic show a large continuous import of food grains into the province from the Punjab and Bengal from the first days of the scarcity. Much of the Burma rice found its way to Bundelkhand and Oudh. With the completion of the cold weather harvest the pressure perceptibly eased off in the less distressed parts of the province, and grain moved in large quantities from them to the more distressed tracts.

In Bengal the great crop of the year is the winter rice which occupies 31 million acres in a total food crop area of 53 million acres. The food crops harvested in the spring occupy 9¼ million acres and the early rain crops of rice and millets 12¾ million acres. The yield of the late rice crop in 1896-97 was returned at under half an average crop, a deficiency of about 8 or 9 million tons of food

The early rain crops of 1896 were 40 per cent. below the average yield. The spring harvest of 1897 was an average one. The agricultural returns of Bengal are less exact than of other parts of India, and it is possible that the crop failure was not quite as great as reported, but even in that case, the production of the year cannot well be placed above two-thirds of the average outturn. This would be much below the requirements of the population for the twelve months. In the distressed districts of North Bihar local stocks were soon exhausted and imports have been on a large scale. Large quantities of Burma rice went there. Elsewhere there must evidently have been considerable reserves of food. Not a few districts have continuously exported and have shown no signs of exhaustion.

In the Central Provinces the outturn in 1896-97 seems to have been fully 55 per cent. below the ordinary yield. With average harvests the province is estimated to produce about 3½ million tons of food grains, of which from 3,00,000 to 4,00,000 tons are in excess of its requirements. In 1896-97 the outturn fell below its actual requirements by about one million tons. The deficiency must have been chiefly met from food stocks existing in the province, as the imports from outside were not large. Within the province grain moved freely from the less distressed districts to the more distressed ones. Great economy of consumption was also practised under the action of acute distress.

In Bombay the Deccan districts enjoyed two good years immediately preceding 1896, and on the estimates of the local agricultural department had in that period accumulated reserves of food equivalent to a nine months' supply. It was fortunate that this was so, for the food grain outturn of the year in the affected districts was little, if anything, over one-fourth of the ordinary yield. Outside the affected area Sind had average harvests, while Gujarat was somewhat in defect. The total outturn of the Bombay Presidency in 1896-97 may be put at five-eighths of the production of an ordinary year, and consequently was less than twelve months' requirements of the population. In Madras the outturn of the distressed area in the Deccan may perhaps be put at one quarter of the average, and in Ganjam and Vizagapatam the outturn was short by probably fifty per cent. elsewhere the deficiency was not great, and as the distressed areas were relatively small, the year's outturn of the Presidency was probably within 20 per cent. of the normal. Stocks also were large. Prices were lower than elsewhere, and the grain exports to other provinces exceeded the imports. Madras, therefore, was not in serious difficulty about its food supplies. In the Berars the autumn crop which there occupies much larger area than the spring crop was said to be short by 50 per cent., and the spring crop by 75 per cent. This is probably an over-estimate of loss. The cultivators were said to have had a year's supply of food grains in hand, and though prices have been high, there seems at all times to have been sufficient food in the province.

Regarding the Native States in which distress has prevailed, it is only possible to speak in general terms about their food production and requirements. In the Nizam's Dominions the distressed districts had, like the Bombay and Madras Deccan country, enjoyed good seasons up to 1896, and entered on the scarcity with large stocks of grain. Much of this was drawn away to British Districts in the first months of the drought, and then holders of grain took alarm and refused to sell. Prices reached a very high level in parts of the state, but there is evidence that considerable reserves still existed. In Bundelkhand and Baghelkhand the year's production of food must have been much below the requirements of the population, as the harvests were as bad as in British Bundelkhand. On the relief works in Rewah considerable quantities of Burma rice were sold, and despite of the prejudice which as a novelty it excited it found its way into remote village marts. The Gwalior and Dholpur states must also have been short of supplies, as they imported grain largely from the Meerut division of the North-Western Provinces and Oudh, and from Rajputana. The Rajputana states, on the other hand, had for the most part fair harvests and considerable stocks and were able to export.

Summarising the results of this investigation as regards British India, the table below indicates that the food outturn of British India (excluding Burma) in 1896-97 was about one-third below that of ordinary years. This represents a deficiency of about 18 or 19 million tons. The consumption of the people under the stress of high prices was unquestionably reduced, and a portion of the deficiency was in this way covered. The rest was made good by reserve stocks, and by the import of about 6,00,000 tons of rice from Burma.

The following gives a tabular summary showing the effect of the drought on different parts of India:—

Province.	Population by present census.	Normal food crop area.	Defect in yield of 1896-97 below the normal.
1. Punjab		Acres.	
2. North-Western Provinces and Oudh .	20,800,000	22,000,000	25 per cent.
3. Bengal	47,000,000	36,000,000	40 "
4. Central Provinces	71,000,000	53 000,000	33 "
5. Berar	10,700,000	14,500,000	55 "
6 Bombay	2,900,000	4,000,000	40 "
7. Madras	18,300,000	23,000,000	35 "
	36,000,000	27,500,000	20 "
TOTAL .	207,200,000	180,000,000	33 "

Vide "Narrative of the Famine in India in 1896-97.")

"The famine of 1896-97 affected an area of about 225,000 square miles in British India and population of 62 millions. The area which was severely affected and to which relief operations ere chiefly confined may be put roughly at 125,000 square miles with a population of 34 millions. the direct relief of distress, apart from loans and advances to landholders and cultivators and missions of land revenue, 727 lakhs of rupees (Rx. 7,270,000) were expended by the State. Relief as thus given to 821 millions of persons at an average cost of 1·42 annas a day for each person lieved. This is equivalent to an average of 2,220,000 persons relieved day by day for the space one year, at the rate of R32·7 per head per annum."

"Among cattle there was a deplorable mortality, and the loss incurred by the agricultural community in this respect must have been very great indeed."

"A noticeable feature of this, as of former famines in the Punjab, was the great mortality that curred among cattle caused by the drying up of fodder supplies. . . . . It will probably never be nown to what extent agricultural stock has been depleted during the past two years, but in the single strict of Hissar no less than 77,134 or 54 per cent. of the plough cattle are estimated to have ssappeared between the 1st May 1896 and the 31st March 1897, a period of eleven months. Acrding to another estimate for the same district "132,325 animals or 92 per cent. of the plough d well cattle of those found to exist in April 1895 disappeared in the two-and-a-half years llowing." From these figures may be formed some idea of the distress and suffering to cattle and e resulting loss to cultivators. The measures adopted by the local Government to mitigate this loss the opening to grazing of Government forests seems to have been as full as circumstances ermitted.—(*Vide* Report of the Indian Famine Commission, 1898, paras. 339, 318, 326.)"

Famine of 1899—1900. The area affected by the recent famine, at the time of maximum essure, in the five British provinces, to which our enquiries extended, was roughly 175,000 square iles, and the population of that area was 25 millions according to the census of 1891. Including the ss afflicted parts of British India, the area and the population affected were, in round numbers, 5,000 square miles and 28 millions respectively.

The circumstances of the famine of 1899-1900 are in many ways peculiar. Both in its mate l manifestations and in the attitude of the people, it differs from preceding famines. Nor was its tensity uniform over the whole tract affected. Over large areas the conditions were rather those scarcity than of famine; but in both scarcity and famine areas the difficulties were aggravated the fact that the failure of the crops was attended, in many parts of the affected provinces, by a lure of the water-supply, and also by a failure of fodder, which in parts of Bombay was practically

complete. This shortness of the water-supply and dearth of fodder told heavily on men and cattle and enormously increased the difficulties of administration, moreover, in the districts bordering on Native States immigration added very greatly to the anxieties of the local officers.

It is estimated that nearly two million cattle, local and immigrant combined, died in the Central Provinces and its feudatory states, and that an equal number died in Bombay. The mortality was also great in Berar and in Ajmer, in which latter district no effective measures were taken to prevent it. Nor was this mortality confined to the useless cattle; valuable bullocks and breeding cattle perished in thousands, involving a loss to agriculturists, from which even with the liberal assistance of Government, it will take them long to recover. This loss was most severe, as its results were most disastrous, in Gujarat, where the fodder famine was complete, and where the wealth of the people was largely sunk in their cattle. In their efforts to save their cattle the Gujarat agriculturists expended all their savings, themselves enduring great privations: they sold their jewels and even the doors and rafters of their houses, we were told, in order to purchase fodder. Their efforts failed, their cattle died, and with their cattle all their accumulated wealth disappeared: so that Gujarat became a stricken field.—(*Vide* Report of the Indian Famine Commission, 1901.)

Appendix B.

No. I. RAINFALL, 1892.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches.	Inches.		Inches.	Inches.	
Burma	1. Tenasserim	24·91	+12·75	+ 51	159·34	+ 7·21	+ 5	184·25	+19·96	+11
	2. Lower Burma Deltaic	13·08	— 1·18	— 9	87·96	— 4·64	— 5	101·04	— 5·82	— 6
	3. Central Burma	10·21	+ 0·58	+ 10	76·10	— 4·44	— 6	86·31	— 3·46	— 4
	4. Upper Do.	...	...	...	...	...	...	...	...	...
	5. Arakan	20·10	— 8·92	— 44	159·50	— 2·14	— 1	179·60	—11·06	— 6
Bengal and Assam.	6. Eastern Bengal	17·81	+ 1·67	+ 9	72·10	— 9·48	— 13	89·91	— 7·81	— 9
	7. Assam Surma	43·38	+22·48	+ 52	85·12	+20·73	+ 24	128·70	+43·21	+34
	8. Do. Brahmaputra	24·59	+10·55	+ 43	61·31	+ 1·41	+ 2	85·90	+11·96	+14
	9. Deltaic Bengal	12·22	— 4·53	— 37	49·60	— 7·09	— 14	61·82	—11·62	—19
	10. Central Do.	8·56	— 1·17	— 14	48·72	—10·15	— 21	57·28	—11·32	—20
	11. North Do.	16·22	+11·51	+ 71	81·34	+14·25	+ 18	97·56	+25·76	+26
	12. Orissa	7·52	— 5·34	— 71	51·01	— 3·46	— 7	58·53	— 8·80	— 15
	13. Chota Nagpur	5·25	— 2·48	— 47	48·20	— 5·33	— 11	53·45	— 7·81	—15
	14. South Bihar	3·54	— 2·02	— 57	39·87	— 4·97	— 12	43·41	— 6·99	—16
	15. North Do.	5·46	— 1·33	— 24	45·78	+ 2·57	+ 6	51·24	+ 1·24	+ 2
United Provinces of Agra and Oudh.	16. United Provinces East	1·94	— 0·50	— 26	36·32	+ 0·30	+ 1	38·26	— 0·20	— 1
	17. South Oudh	1·94	— 0·64	— 33	34·14	+ 3·73	+ 11	36·08	+ 3·09	+ 9
	18. North Do.	2·17	— 1·09	— 50	36·31	+ 2·52	+ 7	38·48	+ 1·43	+ 4
	19. United Provinces Central	1·57	+ 0·03	+ 2	32·29	+ 0·81	+ 3	33·86	+ 0·84	+ 2
	20. United Provinces West	1·73	— 0·26	— 15	27·07	+ 3·32	+ 12	28·80	+ 3·06	+11
	21. United Provinces Submontane	6·02	— 3·64	— 60	42·31	+ 0·14	0	48·33	— 3·50	— 7
Punjab	22. South Punjab	2·34	— 0·65	— 28	11·56	+ 7·21	+ 62	13·90	+ 6·56	+47
	23. Central Do.	2·71	— 1·03	— 38	18·21	+ 5·21	+ 29	20·92	+ 4·18	+20
	24. Punjab Submontane	5·52	— 3·32	— 60	25·50	+ 8·82	+ 35	31·02	+ 5·50	+18
	25. Do. Hills	16·24	—10·45	— 64	47·25	+ 7·63	+ 16	63·49	— 2·82	— 4
	26. North-West Punjab	7·20	— 5·30	— 74	15·99	+ 6·55	+ 41	23·19	+ 1·25	+ 5
	27. West Do.	2·65	— 2·21	— 83	6·37	+ 8·71	+137	9·02	+ 6·50	+72
Bombay and Malabar Coast Districts (Madras).	28. Malabar	10·36	+13·57	+131	107·87	+ 4·47	+ 4	118·23	+18·04	+15
	29. Madras South Central	7·06	+ 0·91	+ 13	29·69	— 5·33	— 18	36·75	— 4·42	—12
	30. Coorg	...	...	...	...	...	...	...	...	...
	31. Mysore	4·99	+ 1·65	+ 33	30·32	— 4·15	— 14	35·31	— 2·50	— 7
	32. Konkan	2·20	+ 2·23	+101	120·80	+14·24	+ 12	123·00	+16·47	+13
	33. Bombay Deccan	2·89	+ 0·69	+ 24	31·08	+12·48	+ 40	33·97	+13·17	+39
	34. Hyderabad North	1·74	— 0·43	— 25	...	...	...	...	...	...
	35. Khandesh	1·30	— 0·70	— 54	28·52	+ 6·63	+ 23	29·82	+ 5·93	+20
Central Provinces and Berar.	36. Berar	2·40	— 2·16	— 90	36·03	+16·43	+ 46	38·43	+14·27	+37
	37. Central Provinces West	1·77	— 1·07	— 60	42·19	+12·93	+ 31	43·96	+11·86	+27
	38. Central Provinces Central	2·08	— 0·98	— 47	50·92	— 3·20	— 6	53·00	— 4·18	— 8
	39. Central Provinces East	2·81	— 2·53	— 90	49·01	+ 8·07	+ 16	51·82	+ 5·54	+11
Bombay (North)	40. Gujarat	0·40	— 0·33	— 83	45·11	+ 7·02	+ 16	45·51	+ 6·69	+15
	41. Kathiawar and Cutch	0·50	— 0·11	— 22	24·29	+ 5·15	+ 21	24·79	+ 5·04	+20
	42. Sind	1·30	— 1·06	— 82	5·15	+ 5·87	+114	6·45	+ 4·81	+75

No. 1. RAINFALL, 1892—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
		Inches.	Inches		Inches.	Inches.		Inches.	Inches	
Rajputana and Central India.	43. Central India East	1·71	— 0·12	— 7	43·37	— 0·13	0	45·08	— 0·25	— 1
	44. Rajputana East, Central India West	1·70	— 0·46	— 27	26·95	+ 5·86	+ 22	28·65	+ 5·40	+19
	45 West Rajputana	1·00	+ 0·30	+ 30	10·85	+10·23	+ 94	11·85	+10·53	+89
Madras	46. East Coast North	4·01	— 2·63	— 66	35·85	+11·42	+ 32	39·86	+ 8·79	+22
	47. Hyderabad South	2·23	— 1·05	— 47	26·12	+19·06	+ 73	28·35	+18·01	+64
	48. Madras Central	2·55	— 1·24	— 49	23·91	+ 6·32	+ 26	26·46	+ 5·08	+19
	49. East Coast Central	2·71	— 2·07	— 76	34·86	+ 1·79	+ 5	37·58	— 0·28	— 1
	50. Do. South	4·96	— 3·58	— 72	37·11	— 9·28	— 25	42·07	—12·86	—31
	51. Madras South	6·47	— 0·62	— 10	22·27	—10·79	— 48	28·74	—11·41	—40

No. 2. NUMBER OF RAINY DAYS, 1892.

Province.	Division.	Dry Season, January to May			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
Burma	1. Tenasserim	...	...	...	...	...	...	...	...	...
	2. Lower Burma Deltaic	...	...	...	...	...	...	...	...	...
	3. Central Burma	...	...	...	...	...	...	...	...	...
	4. Upper Do.	...	...	...	...	...	...	...	...	...
	5. Arakan	...	...	...	...	...	...	...	...	...
Bengal and Assam.	6 Eastern Bengal	22·7	— 2·3	—10	76·7	— 2·0	— 3	99·4	— 4·3	— 4
	7. Assam Surma	40·7	+ 1·2	+ 3	85·7	+12·0	+ 14	126·4	+13·2	+10
	8. Do. Brahmaputra	41·2	+ 2·6	+ 6	70·3	+ 3·3	+ 5	111·5	+ 5·9	+ 5
	9 Deltaic Bengal	17·0	— 4·6	—27	64·5	— 4·7	— 7	81·5	— 9·3	—11
	10. Central Do	13·2	— 0·7	— 5	61·9	— 8·3	— 13	75·1	— 9·0	—12
	11 North Do.	20·2	+ 7·8	+39	70·1	+ 3·0	+ 4	90·3	+10·8	+12
	12. Orissa	11·8	— 8·7	—74	62·4	— 1·8	— 3	74·2	—10·5	—14
	13. Chota Nagpur	9·7	— 3·5	—36	64·4	— 8·8	— 14	74·1	—12·3	—17
	14. South Bihar	6·6	— 3·2	—48	48·9	— 1·8	— 4	55·5	— 5·0	— 9
	15. North Do	8·6	— 1·2	—14	49·8	+ 0·3	+ 1	58·4	— 0·9	— 2
United Provinces of Agra and Oudh.	16. United Provinces East	4·3	— 0·5	—12	41·5	+ 3·3	+ 8	45·8	+ 2·8	+ 6
	17. South Oudh	4·1	— 0·9	—22	38·5	+ 3·9	+ 10	42·6	+ 3·0	+ 7
	18 North Do.	5·2	— 2·1	—40	38·8	+ 4·5	+ 12	44·0	+ 2·4	+ 5
	19. United Provinces Central	3·8	— 0·3	— 8	36·0	+ 4·2	+ 12	39·8	+ 3·9	+10
	20. United Provinces West	4·6	— 1·4	—30	31·3	+ 4·8	+ 15	35·9	+ 3·4	+ 9
	21. United Provinces Submontane	9·7	— 4·2	—43	40·4	+ 5·5	+ 14	50·1	+ 1·3	+ 3
Punjab	22. South Punjab	4·9	— 0·7	—14	14·4	+ 9·2	+ 64	19·3	+ 8·5	+44
	23 Central Do.	5·9	— 1·4	—24	20·1	+ 8·9	+ 44	26·0	+ 7·5	+29
	24. Punjab Submontane	9·8	— 4·9	—50	25·1	+ 8·6	+ 34	34·9	+ 3·7	+11
	25. Do. Hills	21·8	—10·4	—48	48·1	+ 6·6	+ 14	69·9	— 3·8	— 5
	26. North-West Punjab	12·4	— 7·7	—62	19·3	+ 3·8	+ 20	31·7	— 3·9	—12
	27. West Punjab	5·6	— 3·9	—70	8·4	+ 9·1	+108	14·0	+ 5·2	+37

No. 2. NUMBER OF RAINY DAYS, 1892—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
Bombay and Malabar Coast Districts (Madras).	28. Malabar	12·9	+11·4	+88	107·8	+ 5·4	+ 5	120·7	+16·8	+14
	29. Madras South Central	10·6	+ 4·0	+38	36·0	— 2·9	— 8	46·6	+ 1·1	+ 2
	30. Coorg	...	...	...	...	...	...	...	...	...
	31. Konkan	3·4	+ 0·2	+ 6	96·3	+ 8·4	+ 9	99·7	+ 8·6	+ 9
	32. Bombay Deccan	6·0	+ 1·0	+17	49·2	+10·3	+ 21	55·2	+11·3	+20
	33. Khandesh	2·4	— 0·7	—29	44·4	+ 8·5	+ 19	46·8	+ 7·8	+17
Central Provinces and Berar.	34. Berar	...	...	...	...	...	...	...	...	...
	35. Central Provinces West	3·6	— 1·4	—39	50·3	+12·1	+ 24	53·9	+10·7	+20
	36. Central Provinces Central	4·3	— 1·4	—33	53·7	+ 6·0	+ 11	58·0	+ 4·6	+ 8
	37. Central Provinces East	5·2	— 4·3	—83	50·0	+ 8·3	+ 17	55·2	+ 4·0	+ 7
Bombay (North)	38. Gujarat	0·7	— 0·5	—71	48·5	+ 6·6	+ 14	49·2	+ 6·1	+12
	39. Kathiawar and Cutch	0·7	— 0·1	—14	27·9	+10·2	+ 37	28·6	+10·1	+35
	40. Sind	...	...	...	...	...	...	...	...	...
Rajputana and Central India.	41. Central India East	...	...	...	...	...	...	...	...	...
	42. Rajputana East, Central India West	...	...	...	...	...	...	...	...	...
	43. West Rajputana	...	...	...	...	...	...	...	...	...
Madras	44. East Coast North	6·6	— 3·0	—45	47·4	+ 9·9	+ 21	54·0	+ 6·9	+13
	45. Madras Central	4·4	— 0·9	—20	33·7	+11·4	+ 34	38·1	+10·5	+28
	46. East Coast Central	3·7	— 2·3	—62	37·7	+ 5·8	+ 15	41·4	+ 3·5	+ 8
	47. Do. South	5·8	— 1·4	—24	43·8	— 3·4	— 8	49·6	— 4·8	—10
	48. Madras South	9·6	— 0·7	— 7	32·1	—11·8	— 37	41·7	—12·5	—30

No. 3. RAINFALL, 1893.

Province.	Division.	Dry season, January to May.			Wet season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal
		Inches.	Inches.		Inches.	Inches.		Inches.	Inches.	
Burma	1. Tenasserim	24·91	+18·39	+74	159·34	+0·76	0	184·25	+19·15	+10
	2. Lower Burma Deltaic	13·08	+8·09	+62	87·96	—14·51	—16	101·04	—6·42	—6
	3. Central Burma	10·21	+7·29	+71	76·10	—7·89	—10	86·31	—0·60	—1
	4. Upper Do.	...	...	...	...	...	...	...	...	...
	5. Arakan	20·10	+17·52	+87	159·50	—5·86	—4	179·60	+11·66	+6
Bengal and Assam.	6. Eastern Bengal	17·83	+13·71	+60	72·01	+7·01	+10	89·84	+17·72	+20
	7. Assam Surma	39·93	+0·79	+2	86·90	+21·36	+25	126·83	+22·15	+17
	8. Do. Brahmaputra	26·14	—2·50	—10	60·83	—2·96	—5	86·97	—5·46	— 6
	9. Deltaic Bengal	12·20	+12·40	+102	49·60	+5·85	+12	61·80	+18·25	+30
	10. Central Do.	8·32	+12·06	+145	48·83	+5·15	+11	57·15	+17·21	+30
	11. North Do.	16·25	+2·49	+15	83·14	+12·64	+15	99·39	+15·13	+15
	12. Orissa	7·50	+23·30	+311	51·01	—1·39	—3	58·51	+21·91	+37
	13. Chota Nagpur	5·24	+7·94	+152	46·85	+8·51	+18	52·09	+16·45	+32
	14. South Bihar	3·47	+2·92	+84	39·65	+5·95	+15	43·12	+8·87	+21
	15. North Do.	5·35	+0·95	+18	45·84	+10·36	+23	51·19	+11·31	+22

No. 3. RAINFALL, 1893—*concluded*

Province	Division	Dry Season January to May			Wet Season, June to December			Whole Year		
		Average normal	Variation from normal	Percentage variation from normal	Average normal	Variation from normal	Percentage variation from normal	Average normal	Variation from normal	Percentage variation from normal
		Inches	Inches		Inches.	Inches		Inches.	Inches.	
United Provinces of Agra and Oudh	16. United Provinces East	1 86	+2 07	+111	36·32	+12 86	+35	38 18	+14·93	+39
	17 South Oudh	1 94	+2 53	+131	34 15	+11 53	+34	36·09	+14·08	+39
	18 North Do	2 64	+4 51	+171	36·31	+8 03	+22	38 95	+12 54	+32
	19 United Provinces Central	1 57	+2·47	+157	32 29	+4 84	+15	33 86	+7 31	+22
	20 United Provinces West	1 73	+2 21	+128	27 07	−1 38	−5	28·80	+0 83	+3
	21. United Provinces Submontane	5 38	+5 50	+102	42 31	+10·16	+24	47 69	+15 66	+33
Punjab	22 South Punjab	2 25	+2 83	+126	11 51	+5 12	+44	13 76	+7 9	+58
	23 Central Punjab	2 69	+3 65	+136	18 26	+3 40	+19	20·94	+7 05	+34
	24 Punjab Submontane	5 44	+6·24	+115	25 46	+7 33	+29	30·90	+13 57	+44
	25 Punjab Hills	16 47	+5·97	+36	47 42	+0 65	+1	63 89	+6·62	+10
	26 North West Punjab	7 11	+4 88	+69	16·05	+7 84	+49	23 16	+12·72	+55
	27 West Punjab	2 64	+2 55	+97	6 37	+0·90	+14	9·01	+3 45	+38
Bombay and Malabar Coast Districts (Madras)	28 Malabar	10·23	+4 60	+45	116 90	−13 93	−12	127 13	−9 33	−7
	29 Madras South Central	6 31	+2 30	+36	23 25	+4 07	+18	29 56	+6 37	+22
	30 Coorg	4 98	+3 40	+68	99·01	+1 40	+5	13 99	+4 80	+14
	31 Mysore	2·20	+4 55	+207	112 90	−8·53	−8	115 10	−3 97	−3
	32 Konkan	2 91	+3 12	+107	33 45	−0 68	−2	36 36	+2 44	+7
	33 Bombay Deccan	1 94	+5·44	+280	33 31	+13 84	+42	35 25	+19 28	+55
	34 Hyderabad North	1 36	+3 67	+270	31 51	+0 19	+1	32 87	+3 86	+12
	35 Khandesh									
Central Provinces and Berar	36 Berar	1 70	+7 28	+428	38 41	−5·39	−14	40 11	+1 89	+5
	37 Central Provinces West	1 73	+6·35	+367	42 94	−3 26	−8	44 67	+3 09	+7
	38 Central Provinces Central	2 04	+6 22	+305	49 61	+7 28	+15	51 65	+13 51	+26
	39 Central Provinces East	2 74	+3 50	+128	47 20	+9 06	+19	49 94	+11 56	+25
Bombay (North)	40. Gujarat	0 39	+0 27	+69	43 62	+4 05	+11	44 01	+5·22	+12
	41 Kathiawar and Cutch	0 51	+0 45	+88	29·65	+2 13	+7	30 16	+2 58	+8
	42 Sind	1 31	+0 80	+61	5 02	−1 49	−30	6·33	−0·69	−11
Rajputana and Central India	43 Central India East	1 49	+3 72	+256	43 13	−0 79	−2	44 53	+2·91	+7
	44. Rajputana East, Central India West	1 32	+1 67	+127	26 97	+0 46	+2	28 29	+2 13	+8
	45 West Rajputana	1 00	+0 81	+81	10 78	+12 24	+114	11·78	+13·05	+111
Madras	46 East Coast North	3·78	+5 00	+132	35 59	+9 65	+26	40·17	+14 65	+36
	47 Hyderabad South	2 36	+5 53	+234	28 31	+14 42	+51	30·67	+19 95	+65
	48 Madras Central	2 56	+1 75	+68	23 43	+1 72	+7	26·39	+3 47	+13
	49 East Coast Central	2·73	−0 2·	−8	32 46	+8 90	+27	35·19	+8 68	+25
	50 Do South	4 95	+0 08	+2	38 14	+3 97	+10	43·09	+4 03	+9
	51 Madras South	6 33	+2 48	+39	22 50	−0 24	−1	28 83	+2 24	+8

No. 4. NUMBER OF RAINY DAYS, 1893—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
Madras	46. East Coast North.	6·0	+7·7	+128	47·3	+10·8	+23	53·3	+18·5	+35
	47. Hyderabad South	...	...	...	...	...	...	...	...	...
	48. Madras Central	4·4	+4·2	+95	35·0	+5·9	+17	39·4	+10·1	+26
	49. East Coast Central	3·3	+1·5	+45	37·6	+3·2	+9	40·9	+4·7	+11
	50. Do. South	5·8	+2·3	+40	45·7	+1·7	+4	51·5	+4·0	+8
	51. Madras South	9·3	+5·5	+59	32·0	+0·1	0	41·3	+5·6	+14

No. 5. RAINFALL, 1894.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches.	Inches.		Inches.	Inches.	
Burma	1. Tenasserim	24·91	+11·32	+45	159·34	+37·56	+24	184·25	+48·88	+27
	2. Lower Burma Deltaic.	13·08	+ 3·56	+27	87·96	— 5·35	— 6	101·04	— 1·79	— 2
	3. Central Burma	10·21	+1·67	+16	76·10	— 12·19	—16	86·31	—10·52	—12
	4. Upper Do.	...	...	...	...	...	...	...	...	...
	5. Arakan	20·10	—2·05	—10	159·50	—11·52	— 7	179·60	—13·57	— 8
Bengal and Assam.	6. Eastern Bengal	17·87	+ 2·64	+15	71·73	+ 3·81	+ 5	89·60	+ 6·45	+ 7
	7. Assam Surma	39·62	+ 9·80	+25	86·91	+ 18·82	+22	126·53	+28·62	+23
	8. Do. Brahmaputra	26·15	+ 1·80	+ 7	60·88	+12·59	+21	87·03	+14·39	+17
	9. Deltaic Bengal	12·19	— 4·60	—38	49·53	+ 3·91	+ 8	61·72	— 0·75	— 1
	10. Central Do.	8·55	— 3·93	— 46	48·84	+ 6·08	+12	57·39	+ 2·15	+ 4
	11. North Do.	16·27	— 0·21	— 1	84·37	+ 4·17	+ 5	100·64	+ 3·93	+ 4
	12. Orissa	7·36	— 4·51	—61	51·15	+ 4·63	+ 9	58·51	+ 0·12	0
	13. Chota Nagpur	4·95	— 3·15	—64	48·04	+13·11	+27	52·97	+ 9·96	+19
	14. South Bihar	3·47	— 2·06	—59	39·65	+15·11	+38	43·12	+13·05	+30
	15. North Do.	5·35	— 2·78	—52	45·93	+ 8·43	+18	51·28	+ 5·65	+11
United Provinces of Agra and Oudh.	16. United Provinces East.	1·90	+ 0·36	+19	36·34	+26·10	+72	38·24	+26·46	+69
	17. South Oudh	1·94	+ 0·60	+31	34·15	+28·29	+83	36·09	+28·89	+80
	18. North Do.	2·64	— 0·17	— 6	36·31	+30·91	+85	38·95	+30·74	+79
	19. United Provinces Central.	1·56	+ 0·70	+44	32·38	+23·12	+71	33·96	+23·82	+70
	20. Do. West	1·73	+ 0·57	+33	27·14	+ 8·55	+32	28·87	+ 9·12	+32
	21. Do. Submontane.	5·38	+ 0·25	+ 5	42·45	+24·25	+57	47·83	+24·50	+51
Punjab	22. South Punjab	2·23	+ 1·33	+60	11·64	+ 7·66	+66	13·87	+ 8·99	+65
	23. Central Do.	2·70	+ 1·57	+58	18·29	+ 7·94	+43	20·99	+ 9·51	+45
	24. Punjab Submontane.	5·45	+ 2·82	+52	25·56	+15·54	+61	31·01	+18·36	+59
	25. Do Hills	14·98	+ 5·95	+40	47·03	+33·76	+72	62·01	+39·71	+64
	26. North-West Punjab	7·56	+ 2·23	+29	16·04	+ 4·41	+27	23·60	+ 6·64	+28
	27. West Do.	2·65	+ 1·69	+64	6·37	+ 1·54	+24	9·02	+ 3·23	+36
Bombay and Malabar Coast Districts (Madras).	28. Malabar	10·23	+ 0·85	+ 8	116·50	— 9·58	— 8	127·13	— 8·73	— 7
	29. Madras South Central.	6·31	+ 1·01	+16	23·25	— 2·33	—10	29·56	— 1·32	— 4
	30. Coorg	...	...	...	...	...	...	...	...	...
	31. Mysore	5·32	+ 2·01	+38	29·12	— 6·05	—21	34·44	— 4·04	—12
	32. Konkan	2·20	— 1·15	—52	113·10	+ 0·22	0	115·30	— 0·93	— 1
	33. Bombay Deccan	2·91	— 1·01	—35	33·48	— 0·68	— 2	36·39	— 1·69	— 5
	34. Hyderabad North	1·82	— 0·04	— 3	33·67	+ 2·43	+ 7	35·49	+ 2·39	+ 7
	35. Khandesh	1·35	— 0·40	—30	31·57	+ 4·56	+14	32·92	+ 4·16	+13

No. 6. NUMBER OF RAINY DAYS, 1894—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
Bombay and Malabar Coast Districts (Madras).	23. Malabar	12·9	+2·6	+20	106·8	— 2·1	— 2	119·7	+ 0·5	0
	24. Madras South Central.	9·5	+3·4	+36	36·3	— 1·4	— 4	45·8	+ 2·0	+ 4
	25. Coorg	...	...	...	...	...	...	...	...	...
	26. Mysore	8·9	+4·1	+46	44·6	— 5·3	— 12	53·5	— 1·2	— 2
	27. Konkan	3·4	—1·5	—44	96·5	+ 6·4	+ 7	99·9	+ 4·9	+ 5
	28. Bombay Deccan	6·0	+1·2	+20	49·3	— 3·9	— 8	55·3	— 2·7	— 5
	29. Hyderabad North.	...	...	...	...	...	...	...	...	...
	30. Khandesh	2·3	0	0	44·3	+ 5·0	+ 11	46·6	+ 5·0	+11
Central Provinces and Berar.	31. Berar	...	...	...	...	...	...	...	...	...
	32. Central Provinces West.	3·5	—0·8	—23	50·3	+ 14·5	+ 29	53·8	+ 13·7	+25
	33 Central Provinces Central.	4·5	—0·9	—20	53·5	+ 19·0	+ 36	58·0	+ 18·1	+31
	34. Central Provinces East.	5·4	—3·4	—63	50·5	+ 18·6	+ 37	55·9	+ 15·2	+27
Bombay (North)	35. Gujarat	0·7	— 0·1	—14	48·5	+ 9·1	+ 19	49·2	+ 9·0	+18
	36. Kathiawar and Cutch.	0·8	—0·2	—25	28·1	+ 12·2	+ 43	28·9	+ 12·0	+42
	37. Sind	...	...	...	...	...	...	...	...	...
Rajputana and Central India.	38. Central India East	...	...	...	...	...	...	...	...	...
	39. Rajputana East, Central India West.	...	...	...	...	...	...	...	...	...
	40. West Rajputana	...	...	...	...	...	...	...	...	...
Madras	41. East Coast North	5·9	+0·1	+2	47·5	+ 9·4	+ 20	53·4	+ 9·5	+18
	42. Hyderabad South	...	...	...	...	...	...	...	...	...
	43. Madras Central	4·4	+1·2	+27	35·0	+ 1·8	+ 5	39·4	+ 3·0	+ 8
	44. East Coast Central	3·3	+1·1	+33	37·6	+ 1·5	+ 4	40·9	+ 2·6	+ 6
	45. Do. South	5·8	+2·1	+36	45·5	+ 3·1	+ 7	51·3	+ 5·2	+10
	46. Madras South	9·3	+1·2	+13	32·6	— 1·2	— 4	41·9	0	0

No. 7. RAINFALL, 1895.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation of actual from normal.	Percentage variation.	Average normal.	Variation of actual from normal.	Percentage variation.	Average normal.	Variation of actual from normal.	Percentage variation.
		Inches.	Inches.		Inches.	Inches.		Inches.	Inches.	
Burma	1. Tenasserim	24·91	+9·08	+36	159·34	— 4·91	— 3	184·25	+ 4·17	+ 2
	2. Lower Burma Deltaic.	13·08	+1·16	+ 9	87·96	—10·10	—11	101·04	— 8·94	— 9
	3. Central Burma	10·21	+1·59	+16	76·10	—31·93	—42	86·31	—30·34	—35
	4. Upper Do.	...	...	...	...	...	...	...	...	...
	5. Arakan	20·10	—1·58	— 8	159·50	— 33·31	—21	179·60	—34·89	—19

No. 7. RAINFALL, 1895.—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation of actual from normal.	Percentage variation.	Average normal.	Variation of actual from normal.	Percentage variation.	Average normal.	Variation of actual from normal.	Percentage variation.
		Inches.	Inches.		Inches.	Inches.		Inches.	Inches.	
Bengal and Assam.	6. Eastern Bengal	17·95	+0·32	+ 2	72·36	−13·63	−19	60·31	−13·31	−18
	7. Assam Surma	39·45	+1·03	+ 3	76·77	− 1·63	− 2	126·22	− 0·60	0
	8. Do. Brahmaputra.	26·14	−6·00	−23	60·83	+ 4·16	+ 7	86·97	− 1·84	− 2
	9. Dalta'e Bengal	12·22	−3·62	−30	49·51	−14·37	−29	61·73	−17·99	−29
	10. Central Do.	8·62	−2·44	−28	48·70	−13·77	−28	57·32	−16·21	−28
	11. North Do.	16·21	+0·12	+ 1	85·40	− 5·50	− 6	101·61	− 5·38	− 5
	12. Orissa	7·45	−2·20	−30	51·06	+ 8·29	+16	58·51	+ 0·09	+10
	13. Chota Nagpur	4·94	+0·35	+ 7	49·16	− 5·86	−12	54·10	− 5·45	−10
	14 South Bihar	3·52	−0·76	−22	39·53	− 4·08	−10	43·05	− 4·84	−11
	15. North Do.	5·42	−1·09	−20	45·80	− 0·04	0	51·22	− 1·13	− 2
United Provinces of Agra and Oudh.	16. United Provinces East.	1·90	+0·31	+16	36·35	− 3·46	−10	38·25	− 3·15	− 8
	17. South Oudh	1·04	+0·73	+38	34·16	− 1·22	− 4	36·10	− 0·49	− 1
	18. North Do.	2·04	+1·26	+48	31·54	+ 5·50	+17	34·78	+ 6·76	+20
	19. United Provinces Central.	1·59	+1·41	+89	32·40	− 3·46	−11	33·99	− 2·05	− 6
	20. United Provinces West.	1·75	+1·26	+72	27·16	− 2·82	−10	28·91	− 1·56	− 5
	21. United Provinces Submontane.	5·36	+0·46	+ 9	42·25	+ 1·11	+ 3	47·61	+ 1·57	+ 3
Punjab	22. South Punjab	2·23	+0·13	+ 6	11·55	− 2·34	−20	13·78	− 2·21	−16
	23. Central Do.	2·71	+0·99	+37	18·29	− 5·46	−30	21·00	− 4·49	−21
	24. Punjab Submontane.	5·45	+0·36	+ 7	25·57	− 7·55	−30	31·02	− 7·19	−23
	25. Do. Hills	14·83	−3·47	−23	47·03	− 1·15	− 2	61·86	− 4·62	− 7
	26. North West Punjab.	7·01	+1·71	+24	16·02	− 2·31	−14	23·03	− 0·60	− 3
	27. West Punjab	2·78	+0·81	+29	6·36	+ 0·80	+13	9·14	+ 1·61	+18
Bombay and Malabar Coast Districts (Madras).	28. Malabar	10·23	−1·99	−19	116·90	− 1·24	− 1	127·13	− 3·23	− 3
	29. Madras South Central.	6·31	+0·40	+ 6	23·28	+ 4·89	+21	29·59	+ 5·29	+18
	30. Coorg	...	...	...	...	...	...	...	...	...
	31. Mysore	5·31	+1·06	+20	28·72	+ 0·18	+ 1	34·03	+ 1·24	+ 4
	32. Konkan	2·23	−1·47	−67	113·02	−10·10	− 9	115·24	−11·59	−10
	33. Bombay Deccan	2·92	−0·53	−18	33·68	− 0·30	− 1	36·60	− 0·92	− 3
	34. Hyderabad North	1·82	+0·52	+29	33·57	+ 2·01	+ 6	35·39	+ 2·53	+ 7
	35. Khandesh	1·35	−0·63	−47	31·57	− 1·86	− 6	32·92	− 2·49	− 8
Central Provinces and Berar.	36. Berar	...	...	...	...	...	...	...	...	...
	37. Central Provinces West.	1·73	+0·43	+25	42·93	− 4·45	−10	44·66	− 4·02	− 9
	38. Central Provinces Central.	2·01	+1·36	+67	49·59	− 7·31	−15	51·63	− 6·01	−12
	39. Central Provinces East.	2·70	−0·47	−17	52·21	− 2·45	− 5	54·91	− 2·92	− 5
Bombay (North)	40. Gujarat	0·46	−0·32	−80	44·71	−11·22	−25	45·11	−11·54	−26
	41. Kathiawar and Cutch.	0·51	−0·38	−75	27·57	− 6·11	−22	28·08	− 6·49	−23
	42. Sind	1·31	−0·58	−44	4·90	+ 0·23	+ 5	6·21	− 0·35	− 6
Rajputana and Central India.	43. Central India East	1·64	+0·61	+37	42·10	−13·63	−30	43·74	−12·02	−27
	44. Rajputana East, Central India West.	1·31	+0·45	+34	27·10	− 8·50	−31	28·41	− 8·05	−28
	45. West Rajputana	0·99	−0·28	−28	10·85	− 3·10	−29	11·84	− 3·38	−29
Madras	46. East Coast North	3·71	+0·51	+14	37·10	+ 9·02	+24	40·81	+ 9·53	+23
	47. Hyderabad South	2·36	+0·11	+ 5	25·21	+ 1·87	+ 7	30·57	+ 1·98	+ 6
	48. Madras Central	2·56	+0·38	+15	23·76	+ 0·65	+ 3	26·32	+ 1·03	+ 4
	49. East Coast Central	2·73	−0·64	−23	32·46	− 3·92	−12	35·19	− 4·56	−13
	50. Do. South	4·91	−2·03	−41	37·42	+ 7·16	+19	42·36	+ 5·13	+12
	51. Madras South	6·26	−0·49	− 8	22·57	+ 4·86	+22	28·83	+ 4·37	+15

No. 8. NUMBER OF RAINY DAYS, 1895.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole year.		
		Average normal.	Variation of actual from normal.	Percentage variation.	Average normal.	Variation of actual from normal.	Percentage variation.	Average normal.	Variation of actual from normal.	Percentage variation.
Burma	1. Tenasserim	...	...	...	...	...	...	...	...	...
	2. Lower Burma Deltaic.	...	...	...	...	...	...	...	...	...
	3 Central Burma	...	...	...	...	...	...	...	...	...
	4. Upper Do.	...	...	...	...	...	...	...	...	...
	5. Arakan	...	...	...	...	...	...	...	...	...
Bengal and Assam.	6. Eastern Bengal	22·8	−3·7	−16	76·2	− 8·8	−12	99·0	−12·5	−13
	7 Assam Surma	41·6	−5·9	−14	86·1	+ 5·5	+ 6	127·7	− 0·4	0
	8. Do. Brahmaputra.	41·3	−9·4	−23	70·0	− 4·1	− 6	111·3	−13·5	−12
	9. Deltaic Bengal	17·0	−5·6	−33	64·5	−10·6	−16	81·5	−16·2	−20
	10 Central Do.	13·2	−2·0	−15	61·9	−10·9	−18	75·1	−12·9	−17
	11. North Do.	20·4	+ 1·0	+ 5	71·1	− 4·7	− 7	91·5	− 3·7	− 4
	12. Orissa	11·7	− 3·1	−26	62·3	− 4·8	− 8	74·0	− 7·9	−11
	13. Chota Nagpur	0·6	+ 1·5	+16	64·6	− 9·6	−15	74·2	− 8·1	−11
	14. South Bihar	6·9	−1·1	−16	48·2	− 4·1	− 9	55·1	− 5·2	− 9
	15. North Do.	8·7	−0·4	− 5	50·0	− 1·3	− 3	58·7	− 1·7	− 3
United Provinces of Agra and Oudh.	16. United Provinces East.	4·3	+0·2	+ 5	42·1	− 2·6	− 6	46·4	− 2·4	− 5
	17. South Oudh	4·2	+2·5	+60	38·5	− 3·8	−10	42·7	− 1·3	− 3
	18. North Do.	5·2	+3·7	+71	34·1	+ 7·1	+21	39·3	+10·8	+27
	19. United Provinces Central.	3·9	+3·1	+79	35·8	- 2·0	− 6	39·7	+ 1·1	+ 3
	20. United Provinces West.	4·6	+3·4	+74	31·5	− 2·2	− 7	36·1	+ 1·2	+ 3
	21. United Provinces Submontane.	8·6	+3·7	+43	40·9	+ 1·1	+ 3	49·5	+ 4·8	+10
Punjab	22. South Punjab	4·9	+1·6	+33	14·3	0·1	− 1	19·2	+ 1·5	+ 8
	23. Central Do.	6·0	+3·2	+53	20·0	− 1·6	− 8	26·0	+ 1·6	+ 6
	24. Punjab Submontane.	9·6	+3·3	+31	25·3	− 0·6	− 2	34·9	+ 2·7	+ 8
	25. Punjab Hills	21·8	−1·0	− 5	48·2	+ 0·9	+ 2	70·0	− 0·1	0
	26 North West Punjab	12·3	+4·7	+38	18·6	− 1·3	− 7	30·9	+ 3·4	+11
	27. West Do.	5·9	+1·8	+31	16·0	− 5·1	−32	21·9	− 3·3	−15
Bombay and Malabar Coast Districts (Madras)	28. Malabar	12·9	−1·3	−10	106·8	− 5·1	− 5	119·7	− 6·4	− 5
	29. Madras South Central.	9·5	+0·4	+ 4	36·3	+ 4·9	+13	45·8	+ 5·3	+12
	30. Coorg	...	...	...	...	...	...	...	...	...
	31. Mysore	9·0	+0·8	+ 9	44·1	+ 1·1	+ 2	53·1	+ 1·9	+ 4
	32 Konkan	3·1	−1·9	−56	96·3	− 1·1	− 1	99·7	− 3·0	− 3
	33. Bombay Deccan	5·9	−1·1	−19	49·5	− 1·2	− 2	55·4	− 2·3	− 4
	34. Hyderabad North	...	...	...	...	...	...	...	...	...
	35 Khandesh	2·2	−0·4	−18	44·3	− 1·9	− 4	46·5	− 2·3	− 5
Central Provinces and Berar.	36 Berar	...	...	...	...	...	...	...	...	...
	37. Central Provinces West.	3·5	+2·4	+69	50·2	− 5·6	−11	53·7	− 3·2	− 6
	38. Central Provinces Central	4·5	+3·0	+67	53·4	− 2·9	− 5	57·9	+ 0·1	0
	39. Central Provinces East.	5·1	+0·8	+16	50·1	+ 1·7	+ 3	55·2	+ 2·5	+ 5
Bombay (North).	40. Gujarat	0·7	−0·4	−57	48·6	− 4·4	− 9	49·3	− 4·8	−10
	41. Kathiawar and Cutch.	0·8	−0·4	−50	27·9	+ 2·4	+ 9	28·7	+ 2·0	+ 7
	42. Sind	...	...	...	...	...	...	...	...	...
Rajputana and Central India.	43. Central India East	...	...	...	...	...	...	...	...	...
	44. Rajputana East, Central India West.	...	...	...	...	...	...	...	...	...
	45. West Rajputana	...	...	...	...	...	...	...	...	...

No. 8. NUMBER OF RAINY DAYS, 1895—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
Madras	46. East Coast North	5·9	+1·0	+17	47·7	+ 7·6	+16	53·6	+ 8·6	+16
	47. Hyderabad South	...	...	...	...	...	...	...	...	...
	48. Madras Central	4·4	+1·5	+34	34·8	+ 3·1	+ 9	39 2	+ 4·6	+12
	49. East Coast Central	3·3	−0·2	− 6	37·6	+ 2·8	+ 7	40·9	+ 2·6	+ 6
	50. East Coast South	5·8	−1·0	−17	45·5	+ 5·0	+11	51·3	+ 4·0	+ 8
	51. Madras South	9·3	0	0	32·3	+ 3·1	+10	41·6	+ 3·1	+ 7

No. 9. RAINFALL, 1896.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches.	Inches.		Inches.	Inches.	
Burma	1. Tenasserim	24·91	+6 06	+24	159·34	+32·89	+21	184·25	+38·95	+21
	2. Lower Burma Deltaic	13·08	+ 0·50	+4	87·96	+17·65	+20	101 04	+18·15	+18
	3. Central Burma	10·21	− 3·47	−34	76·10	−27·79	−27	86·31	−31·26	−36
	4. Upper Do.	0·36	+ 0 00	+1	31·34	− 2·13	− 7	37·70	− 2 04	− 5
	5. Arakan	20·10	−11·55	−57	159·50	+25 41	+16	179·60	+13·86	+ 8
Bengal and Assam.	6. Eastern Bengal	19·10	−1·22	−6	70·21	−17·56	−25	89 31	−18 78	−21
	7. Assam Surma	40·05	+7·26	+18	86·83	−20 33	−23	126 88	−13 07	−10
	8. Do. Hills	27·29	−0·58	−2	95·25	−19·79	−21	122·54	−20·37	−17
	9. Do. Brahmaputra	27·41	+0·23	+1	62·16	− 9·16	−15	89·57	− 8·93	−10
	10 Deltaic Bengal	11·35	−3·67	−32	48·79	− 6·66	−14	60·14	−10·33	−17
	11. Central Do.	8·81	−3 08	−35	47·12	− 9·91	−21	56·23	−12 99	−23
	12. North Do.	16·60	+2·39	+14	77·77	−24·80	−32	91·37	−22·41	−24
	13. Bengal Hills	20·93	−3·16	−15	116·49	−29·54	−25	137·42	−32·70	−24
	14. Orissa	7·97	−3·75	−47	51·81	+ 2 85	+ 6	59·78	− 0·90	− 2
	15. Chota Nagpur	5·35	−3 92	−73	48·35	− 0·24	0	53·70	− 4·16	− 8
	16. South Bihar	3·33	−2 35	−71	40·19	− 7·49	−19	43 52	− 9·84	−23
	17. North Do.	5 34	−1·54	−29	48·21	−16·42	−34	53·55	−17·96	−34
United Provinces of Agra and Oudh.	18. United Provinces East	1·90	−1·78	−94	36·33	−12·64	−35	38·23	−14·42	−38
	19. South Oudh	1·94	−1·80	−93	34·16	−16·05	−47	36 10	−17·85	−49
	20. North Do.	2·64	−2·12	−80	36·31	− 6·43	−18	38·95	− 8·55	−22
	21. United Provinces Central	1·53	−1·20	−78	32·81	−13·15	−40	34·34	−14·35	−42
	22. United Provinces West	1·88	−0·78	−41	24·38	− 6·59	−27	26·26	− 7·37	−28
	23. United Provinces East Submontane	2·75	−2·40	−87	39·87	−15 47	−39	42·62	−17 87	−42
	24. United Provinces West Submontane	4·32	−2·79	−65	41·16	− 7·36	−18	45·78	−10·15	−22
	25. United Provinces Hills	9·74	−5·00	−51	51·12	− 5·98	−12	60 86	−10·98	−18

No. 9. RAINFALL, 1896—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches.	Inches		Inches	Inches.	
Punjab	26. South-East Punjab	2·38	—0·67	—28	20·97	— 6·26	—30	23·35	— 6·93	—30
	27. South Do.	2·48	—0·81	—33	13·54	— 5·13	—38	16·02	— 5·94	—37
	28. Central Do.	4·36	—2·13	—49	14·76	— 5·43	—37	19·12	— 7·56	—40
	29. Punjab Submontane	5·34	—2·44	—46	24·58	— 5·78	—24	29·92	— 8·22	—27
	30. Punjab Hills	14·60	—4·94	—34	47·01	— 4·34	— 9	61·67	— 9·28	—15
	31. North Punjab	7·79	—2·46	—32	13·47	— 2·03	—15	21·26	— 4·49	—21
	32. West Do.	2·61	—0·20	—8	6·78	— 1·52	—28	9·39	— 2·12	—23
Bombay and Malabar Coast Districts (Madras).	33. Malabar	10·22	— 0·63	—6	116·90	+17·42	+15	127·12	+16·79	+13
	34. Madras South Central	6·31	—3·36	—53	23·28	+ 2·74	+12	29·59	— 0·62	— 2
	35. Mysore	5·39	—1·26	—23	28·59	+ 6·18	+22	33·98	+ 4·92	+14
	36. Konkan	2·22	—1·26	—57	113·66	+10·04	+ 9	115·88	+ 8·78	+ 8
	37. Bombay Deccan	2·92	—0·01	0	33·72	+ 1·64	+ 5	36·64	+ 1·63	+ 4
	38. Hyderabad North	1·74	—1·13	—65	34·55	— 8·86	—26	36·29	— 9·99	—28
	39. Khandesh	1·35	—0·81	—60	31·50	+ 0·77	+ 2	32·85	— 0·04	0
Central Provinces and Berar.	40. Berar	1·90	—1·23	—65	38·66	—12·76	—33	40·56	—13·99	—34
	41. Central Provinces West	1·73	—1·54	—89	42·98	+ 0·55	+ 1	44·71	— 0·99	— 2
	42. Central Provinces Central	2·04	—1·94	—95	49·60	+ 3·29	+ 7	51·64	+ 1·35	+ 3
	43. Central Provinces East	2·70	—2·42	—90	47·21	+19·63	+42	49·91	+17·21	+34
Bombay (North)	44. Gujarat	0·39	—0·39	—100	43·63	+ 3·97	+ 9	44·02	+ 3·58	+ 8
	45. Kathiawar and Cutch	0·51	—0·44	—86	26·56	+ 3·95	+15	27·07	+ 3·51	+13
	46. Sind	1·31	—0·92	—70	4·71	— 1·41	—30	6·02	— 2·33	—39
	47. Baluchistan Hills	6·61	—2·48	—38	1·66	+ 1·72	+104	8·27	— 0·76	— 9
Rajputana and Central India.	48. Central India East	1·64	—1·51	—92	42·24	—12·07	—29	43·88	—13·58	—31
	49. Rajputana East, Central India West	1·17	—0·95	—81	27·10	— 7·59	—28	28·27	— 8·54	—30
	50. West Rajputana	1·00	—0·79	—79	10·85	— 0·30	— 3	11·85	— 1·09	— 9
Madras	51. East Coast North	3·68	—1·30	—38	37·08	— 9·16	—27	40·76	—11·25	—28
	52. Hyderabad South	2·50	—1·86	—74	26·87	— 7·41	—28	29·37	— 9·27	—32
	53. Madras Central	2·56	— 0·18	— 7	23·39	— 9·88	—42	25·95	—10·06	—39
	54. East Coast Central	2·73	—1·57	—58	32·46	+ 2·29	+ 7	35·19	+ 0·72	+ 2
	55. East Coast South	4·97	—3·33	—67	37·42	+ 2·72	+ 7	42·39	— 0·61	— 1
	56. Madras South	5·96	—2·22	—37	22·57	+12·36	+55	28·53	+10·14	+36

No. 10. NUMBER OF RAINY DAYS, 1896.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
Burma	1. Tenasserim	...	...	...	...	...	...	...	...	...
	2. Lower Burma Deltaic	...	...	...	...	...	...	...	...	...
	3. Central Burma	...	...	...	...	...	...	...	...	...
	4. Upper Do.	...	...	...	...	...	...	...	...	...
	5. Arakan	...	...	...	...	...	...	...	...	...

No. 10. NUMBER OF RAINY DAYS, 1896—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
Bengal and Assam.	6. Eastern Bengal	22·5	−2·1	− 9	73·7	−11·6	−16	96·2	−13·7	−14
	7. Assam Surma	42·7	+8·0	+19	86·2	−10·8	−13	128·9	− 2·8	− 2
	8. Do. Hills	38·1	+0·4	+ 1	91·6	−14·7	−16	129·7	−14·3	−11
	9. Do. Brahmaputra	40·8	−2·5	− 6	70·8	− 7·5	−11	111·6	−10·0	− 9
	10. Deltaic Bengal	16·6	−3·6	−22	63·8	− 6·9	−11	80·4	−10·5	−13
	11. Central Do.	13·1	−3·5	−27	60·0	−12·5	−21	73·1	−16·0	−22
	12. North Do.	19·7	+1·9	+10	65·5	−14·8	−23	85·2	−12·9	−15
	13. Bengal Hills	29·4	−0·1	0	91·3	−10·4	−11	120·7	−10·5	− 9
	14. Orissa	11·0	−2·0	−18	61·5	− 2·9	− 5	72·5	− 4·9	− 7
	15. Chota Nagpur	9·2	−6·3	−68	60·5	− 5·6	− 9	69·7	−11·9	−17
	16. South Bihar	6·1	−4·3	−70	47·1	−12·2	−26	53·2	−16·5	−31
	17. North Do.	8·7	−3·0	−34	50·8	−15·6	−31	59·5	−18·6	−31
United Provinces of Agra and Oudh.	18. United Provinces East	4·3	−4·0	−93	41·6	− 6·8	−16	45·9	−10·8	−24
	19. South Oudh	4·2	−3·8	−90	39·0	− 9·9	−25	43·2	−13·7	−32
	20. North Do.	5·2	−3·8	−73	38·8	− 5·6	−14	44·0	− 9·4	−21
	21. United Provinces Central	3·8	−3·0	−79	36·8	− 8·8	−24	40·6	−11·8	−29
	22. United Provinces West	4·8	−2·4	−50	27·9	− 8·1	−29	32·7	−10·5	−32
	23. United Provinces East Submontane	5·3	−4·6	−87	42·2	−12·7	−30	47·5	−17·3	−36
	24. United Provinces West Submontane	8·5	−4·2	−49	38·5	− 4·3	−11	47·0	− 8·5	−18
	25. United Provinces Hills	17·3	−6·7	−39	58·5	− 8·5	−15	75·8	−15·2	−20
Punjab	26. South-East Punjab	5·6	−1·1	−20	23·5	− 5·6	−24	29·1	− 6·7	−23
	27. South Do.	5·6	−0·9	−16	16·1	− 0·6	− 4	21·7	−1·5	− 7
	28. Central Do.	8·9	−2·1	−24	16·7	− 2·5	−15	25·6	−4·6	−18
	29. Punjab Submontane	9·5	−1·8	−19	24·7	0	0	34·2	− 1·8	− 5
	30. Punjab Hills	21·8	−1·7	− 8	48·1	− 2·8	− 6	69·9	− 4·5	− 6
	31. North Punjab	13·2	+0·8	+ 6	17·0	+ 0·7	+ 4	30·2	+ 1·5	+ 5
	32. West Do.	5·3	+1·9	+36	9·0	− 1·5	−17	14·3	+ 0·4	+ 3
Bombay and Malabar Coast Districts (Madras).	33. Malabar	12·9	−0·8	− 6	106·8	− 0·3	0	119·7	− 1·1	− 1
	34. Madras South Central	9·5	−4·2	−44	36·3	+ 5·8	+16	45·8	+ 1·6	+ 3
	35. Mysore	8·3	−1·9	−22	44·2	+ 2·2	+ 5	53·0	+ 0·3	+ 1
	36. Konkan	3·4	−1·5	−44	96·6	−10·5	−11	100·0	−12·0	−12
	37. Bombay Deccan	5·8	−2·0	−34	46·7	− 1·4	− 3	52·5	− 3·4	− 6
	38. Khandesh	2·2	−1·0	−45	44·3	− 3·7	− 8	46·5	− 4·7	−10
Central Provinces and Berar.	39. Central Provinces West	3·6	−3·0	−83	50·3	− 6·1	−12	53·9	− 9·1	−17
	40. Central Provinces Central	4·5	−4·2	−93	53·6	− 2·1	− 4	58·1	− 6·3	−11
	41. Central Provinces East	5·3	−4·8	−91	50·1	+ 5·3	+11	55·4	+ 0·5	+ 1
Bombay North	42. Gujarat	0·7	−0·7	−100	48·4	+ 2·4	+ 5	49·1	+ 1·7	+ 3
	43. Kathiawar and Cutch	0·7	−0·6	−86	27·9	+ 4·1	+15	28·6	+ 3·5	+12
	44. Sind	...	...	...	...	...	...	...	...	...
	45. Baluchistan Hills	...	...	...	...	...	...	...	...	...
Rajputana and Central India.	46. Central India East	...	...	...	...	...	...	...	...	...
	47. Rajputana East, Central India West	...	...	...	...	...	...	...	...	...
	48. West Rajputana	...	...	...	...	...	...	...	...	...
Madras	49. East Coast North	5·9	−1·8	−31	47·7	− 6·1	−13	53·6	− 7·9	−15
	50. Madras Central	4·3	−0·3	− 7	34·9	− 7·6	−22	39·2	− 7·9	−20
	51. East Coast Central	3·3	−1·0	−30	37·6	+ 3·5	+ 9	40·9	+ 2·5	+ 6
	52. East Coast South	5·8	−2·8	−48	45·5	+ 3·1	+ 7	51·3	+ 0·3	+ 1
	53. Madras South	9·3	−2·6	−28	32·3	+14·3	+44	41·6	+11·7	+28

No. II. RAINFALL, 1897.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole year.		
		Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches.	Inches.		Inches.	Inches.	
Burma	1. Tenasserim	21·14	+6·97	+33	151·81	+25·28	+17	172·95	+32·25	+19
	2. Lower Burma Deltaic	12·28	+1·31	+11	81·43	+ 6·70	+ 8	93·71	+ 8·01	+ 9
	3. Central Burma	6·13	+4·12	+67	52·98	− 5·18	−10	59·11	− 1·06	− 2
	4. Upper Do.	6·36	−0·01	0	39·31	− 5·53	−14	45·67	− 5·54	−12
	5. Arakan	19·56	−8·84	−45	158·48	− 2·72	− 2	178·04	−11·56	− 6
Bengal and Assam.	6. Eastern Bengal	18·65	−4·54	−24	69·04	+ 4·11	+ 6	87·69	− 0·43	0
	7. Assam Surma	39·91	−4·11	−10	86·90	+ 6·99	+ 8	126·81	+ 2·88	+ 2
	8. Do. Hills	27·68	+6·28	+23	110·83	+ 4·04	+ 4	138·51	+10·32	+ 7
	9. Do. Brahmaputra	26·44	−1·52	− 6	61·81	+ 8·51	+14	88·25	+ 6·99	+ 8
	10. Deltaic Bengal	11·91	−2·57	−22	48·76	+ 3·66	+ 8	60·67	+ 1·09	+ 2
	11. Central Do.	8·97	−1·24	−14	47·09	+ 0·34	+ 1	56·06	− 0·90	− 2
	12. North Do.	16·59	+0·33	+ 2	77·77	− 1·05	− 1	94·36	− 0·72	− 1
	13. Bengal Hills	21·71	−7·32	−34	120·14	−17·56	−15	141·85	−24·88	−18
	14. Orissa	8·07	+0·88	+11	51·81	+ 1·62	+ 3	59·88	+ 2·50	+ 4
	15. Chota Nagpur	5·58	+0·76	+14	48·15	+ 0·63	+ 1	53·73	+ 1·39	+ 3
	16. South Bihar	3·71	−0·72	−19	40·10	+ 9·84	+25	43·81	+ 9·12	+21
	17. North Do.	5·64	−0·52	− 9	47·61	+ 1·07	+ 2	53·25	+ 0·55	+ 1
United Provinces of Agra and Oudh.	18. United Provinces East	1·90	−0·18	− 9	36·35	+10·23	+28	38·25	+10·05	+26
	19. South Oudh	1·94	−0·29	−15	34·16	+ 3·24	+ 9	36·10	+ 2·95	+ 8
	20. North Do.	2·64	−0·32	−12	36·31	+ 3·45	+10	38·95	+ 3·13	+ 8
	21. United Provinces Central	1·54	−0·13	− 8	32·81	− 1·43	− 4	34·35	− 1·56	− 5
	22. United Provinces West	1·92	−1·36	−71	24·41	+ 5·20	+21	26·33	+ 3·84	+15
	23. United Provinces East Submontane	2·76	−0·90	−33	39·87	+ 6·10	+15	42·63	+ 5·20	+12
	24. United Provinces West Submontane	4·55	−1·83	−40	41·67	+ 4·83	+12	46·22	+ 3·00	+ 6
	25. United Provinces Hills	9·67	−2·57	−27	51·30	+16·08	+31	60·97	+13·51	+22
Punjab	26. South-East Punjab	2·38	−1·52	−64	20·97	− 2·62	−12	23·35	− 4·14	−18
	27. South Do.	2·48	−0·56	−23	13·54	− 1·19	− 9	16·02	− 1·75	−11
	28. Central Do.	4·36	−0·48	−11	14·52	− 1·60	−11	18·88	− 2·08	−11
	29. Punjab Submontane	5·65	−0·56	−10	25·22	− 5·59	−22	30·87	− 6·15	−20
	30. Do. Hills	14·98	+1·26	+ 8	47·03	− 4·50	−10	62·01	− 3·24	− 5
	31. North Punjab	7·79	+3·94	+51	13·28	+ 2·15	+16	21·07	+ 6·09	+29
	32. West Do.	2·41	−0·18	− 7	6·61	+ 3·83	+58	9·02	+ 3·65	+40
Bombay and Malabar Coast Districts (Madras).	33. Malabar	10·23	−0·80	− 8	116·46	+34·86	+30	126·69	+34·06	+27
	33-A. Travancore	...	...	...	...	...	....	...	...	...
	34. Madras South Central	6·31	+0·93	+15	23·28	+ 2·95	+13	29·59	+ 3·88	+13
	35. Coorg	...	...	...	...	...	...	...	...	...
	36. Mysore	5·36	−0·53	−10	29·17	+ 6·83	+23	34·53	+ 6·30	+18
	37. Konkan	2·20	−1·27	−58	112·87	+12·69	+11	115·07	+11·42	+10
	38. Bombay Deccan	2·88	+0·15	+ 5	33·70	+ 0·10	0	36·58	+ 0·25	+ 1
	39. Hyderabad North	1·74	−0·45	−26	34·44	− 5·52	−16	36·18	− 5·97	−17
	40. Khandesh	1·35	−1·11	−82	31·47	− 0·36	− 1	32·82	− 1·47	− 4
Central Provinces and Berar.	41. Berar	1·90	−0·93	−49	38·66	− 8·71	−23	40·56	− 9·64	−24
	42. Central Provinces West	1·73	+0·21	+12	42·98	− 1·53	− 4	44·71	− 1·32	− 3
	43. Central Provinces Central	2·03	+0·64	+32	49·60	− 7·08	−14	51·63	− 6·44	−12
	44. Central Provinces East	2·70	+3·32	+123	47·32	+ 0·25	+ 1	50·02	+ 3·57	+ 7

No. 11. RAINFALL, 1897—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches	Inches.		Inches.	Inches.	
Bombay (North).	45. Gujarat	0·40	−0·40	−100	43·81	− 8·93	−20	44·21	− 9·33	−21
	46. Kathiawar & Cutch	0·50	−0·45	−90	26·57	+ 2·47	+ 9	27·07	+ 2·02	+ 7
	47. Sind	1·31	−0·88	−67	4·72	+ 3·98	+84	6·03	+ 3·10	+51
	48. Baluchistan Hills	5·20	+0·30	+ 6	4·09	− 0·12	− 3	9·29	+ 0·18	+ 2
Rajputana and Central India.	49. Central India East	1·70	−0·45	−26	41·85	− 6·89	−16	43·55	− 7·34	−17
	50. Rajputana East, Central India West	1·37	−1·01	−74	26·66	− 4·44	−17	28·03	− 5·45	−19
	51. West Rajputana	1·15	−0·88	−77	11·37	+ 2·33	+20	12·52	+ 1·45	+12
Madras	52. East Coast North	3·71	+1·72	+46	35·74	+ 6·25	+17	39·45	+ 7·97	+20
	53. Hyderabad South	2·51	−0·92	−37	26·30	− 0·67	− 3	28·81	− 1·59	− 6
	54. Madras Central	2·57	−0·44	−17	23·73	+ 0·09	0	26·30	− 0·35	− 1
	55. East Coast Central	2·73	+0·83	+30	32·46	− 9·68	−30	35·19	− 8·85	−25
	56. Do. South	4·96	+0·15	+ 3	37·44	− 8·01	−21	42·40	− 7·86	−19
	57. Madras South	6·30	+2·28	+36	22·57	− 3·73	−17	28·87	− 1·45	− 5

No. 12. NUMBER OF RAINY DAYS, 1897.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.
Burma	1. Tenasserim	...	...	...	...	...	...	...	...	...
	2. Lower Burma Deltaic.	...	...	...	...	...	...	...	...	...
	3. Central Burma	...	...	...	...	...	...	...	...	...
	4. Upper Do.	...	...	...	...	...	...	...	...	...
	5. Arakan	...	...	...	...	...	...	...	...	...
Bengal and Assam.	6. Eastern Bengal	21·7	−5·1	−24	72·8	+3·2	+4	94·5	−1·9	−2
	7. Assam Surma	41·9	−2·6	−6	86·2	+10·3	+12	128·1	+7·7	+6
	8. Do. Hills	37·4	−4·2	−11	93·5	−3·9	−4	130·9	−8·1	−6
	9. Do. Brahmaputra	41·4	−5·0	−12	71·0	+6·8	+10	112·4	+1·8	+2
	10. Deltaic Bengal	16·6	−1·1	−7	63·8	+3·6	+6	80·4	+2·5	+3
	11. Central Do.	13·2	+0·2	+2	59·7	+0·5	+1	72·9	+0·7	+1
	12. North Do.	19·8	+1·9	+10	65·4	+3·0	+5	85·2	+4·9	+6
	13. Bengal Hills	28·9	−2·9	−10	93·1	+2·5	+3	122·0	−0·4	0
	14. Orissa	11·3	−0·4	−4	62·0	+3·4	+5	73·3	+3·0	+4
	15. Chota Nagpur	9·5	+4·7	+49	59·4	+4·4	+7	68·9	+9·1	+13
	16. South Bihar	6·2	+0·7	+11	47·2	+5·3	+11	53·4	+6·0	+11
	17. North Do.	8·9	+0·3	+ 3	50·3	+2·5	+5	59·2	+2·8	+5

No. 12. NUMBER OF RAINY DAYS, 1897—*concluded*.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole year.		
		Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.
United Provinces of Agra and Oudh.	18. United Provinces East	4·3	+0·6	+14	41·6	+7·2	+17	45·9	+7·8	+17
	19. South Oudh	4·2	−1·4	−33	38·5	+1·3	+3	42·7	−0·1	0
	20. North Do.	5·2	−0·9	−17	38·8	+2·0	+5	44·0	+1·1	+3
	21. United Provinces Central	3·8	−1·4	−37	36·8	−0·1	0	40·6	−1·5	−4
	22. United Provinces West	4·9	−2·5	−51	28·1	+3·1	+11	33·0	+0·6	+2
	23. United Provinces East Submontane	5·3	−0·9	−17	42·0	+3·6	+9	47·3	+2·7	+6
	24. United Provinces West Submontane	8·6	−2·1	−24	38·8	+2·0	+5	47·4	−0·1	0
	25. United Provinces Hills	17·5	−2·8	−16	60·3	−3·3	−5	77·8	−6·1	−8
Punjab	26. South-East Punjab	5·5	−2·8	−51	23·6	−1·4	−6	29·1	−4·2	−14
	27. South Do.	5·3	−1·0	−19	16·1	+1·2	+7	21·4	+0·2	+1
	28. Central Do.	8·9	+0·3	+3	16·7	+1·0	+6	25·6	+1·3	+5
	29. Punjab Submontane	9·8	+1·1	+11	24·7	+1·4	+6	34·5	+2·5	+7
	30. Punjab Hills	21·9	+5·9	+27	48·2	−1·4	−3	70·1	+4·5	+6
	31. North Punjab	13·1	+9·4	+72	17·0	+3·6	+21	30·1	+13·0	+43
	32. West Do.	5·3	+0·4	+8	9·0	+6·2	+69	14·3	+6·6	+46
Bombay and Malabar Coast Districts (Madras).	33 Malabar	12·9	−0·7	−5	106·8	−4·1	−4	119·7	−4·8	−4
	33-A. Travancore	...	...	...	...	...	...	...	...	...
	34. Madras South Central	9·4	+3·1	+33	36·3	−0·2	−1	45·7	+2·9	+6
	35. Coorg	...	...	...	...	...	...	...	...	...
	36 Mysore	9·0	−0·8	−9	41·3	+4·7	+11	53·3	+3·9	+7
	37. Konkan	3·4	−1·6	−47	96·3	−1·0	−1	99·7	−2·6	−3
	38 Bombay Deccan	5·9	−0·3	−5	49·4	−2·1	−4	55·3	−2·4	−4
	39 Hyderabad North	...	...	...	...	...	...	...	...	...
	40. Khandesh	2·3	−1·6	−70	44·3	−2·0	−5	46·6	−3·6	−8
Central Provinces and Berar.	41. Berar	...	...	...	...	...	...	...	...	...
	42. Central Provinces West	3·6	+0·8	+22	50·4	−3·3	−7	54·0	−2·5	−5
	43. Central Provinces Central	4·5	+2·0	+44	53·5	−1·2	−2	58·0	+0·8	+1
	44. Central Provinces East	5·3	+6·2	+117	50·8	+4·5	+9	56·1	+10·7	+19
Bombay (North)	45. Gujarat	0·7	−0·7	−100	48·0	−0·4	−1	48·7	−1·1	−2
	46 Kathiawar and Cutch	0·8	−0·6	−75	27·7	+10·5	+38	28·5	+9·9	+35
	47. Sind	...	...	...	...	...	...	...	...	...
	48. Baluchistan Hills	...	...	...	...	...	...	...	...	...
Rajputana and Central India.	49. Central India East	...	...	...	...	...	...	...	...	...
	50. Rajputana East, Central India West	...	...	...	...	...	...	...	...	...
	51. West Rajputana	...	...	...	...	...	...	...	...	...
Madras	52. East Coast North	5·9	+2·9	+49	47·7	+8·4	+18	53·6	+11·3	+21
	53 Hyderabad South	...	...	...	...	...	...	...	...	...
	54. Madras Central	4·4	−0·1	−2	34·9	+0·8	+2	39·3	+0·7	+2
	55. East Coast Central	3·3	+1·3	+39	37·6	−2·7	−7	40·9	−1·4	−3
	56. Do. South	5·8	+1·4	+24	45·4	−5·5	−12	51·2	−4·1	−8
	57. Madras South	9·3	+2·3	+25	32·3	−2·2	−7	41·6	+0·1	0

No. 13. RAINFALL, 1898 – *concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches.	Inches.		Inches.	Inches.	
Central Provinces and Berar.	40. Berar	1·90	− 0·83	− 44	38·66	−12·23	−32	40·56	−13·06	−32
	41. Central Provinces West	1·70	− 0·27	− 16	42·95	− 2·74	− 6	44·65	− 3·01	− 7
	42. Central Provinces Central.	2·01	+ 1·07	+ 53	49·50	+ 2·63	+ 5	51·51	+ 3·70	+ 7
	43. Central Provinces East.	2·76	− 0·39	− 14	47·32	− 2·55	− 5	50·08	− 2·94	− 6
Bombay (North)	44. Gujarat	0·40	+ 1·04	+260	43·63	− 0·88	− 2	44·03	+ 0·16	0
	45. Kathiawar and Cutch.	0·51	+ 0·28	+ 55	26·57	− 4·06	−15	27·08	− 3·78	−14
	46. Sind.	1·31	− 0·65	− 50	4·68	+ 0·19	+ 4	5·99	− 0·46	− 8
	47. Baluchistan Hills	5·38	− 2·11	− 39	4·12	− 2·44	−59	9·50	− 4·55	−48
Rajputana and Central India.	48. Central India East	1·74	+ 0·80	+ 46	41·68	− 4·70	−11	43·42	− 3·90	− 9
	49. Rajputana East, Central India West.	1·48	+ 0·47	+ 32	26·68	8·84	−33	28·16	− 8·37	−30
	50. West Rajputana	1·15	− 0·19	− 17	11·38	− 4·00	−35	12·53	− 4·19	−33
Madras	51. East Coast North	3·71	− 0·08	− 2	35·86	+ 1·68	+ 5	39·57	+ 1·60	+ 4
	52. Hyderabad South	2·51	− 0·16	− 6	26·87	+ 0·89	+ 3	29·38	+ 0·73	+ 2
	53. Madras Central	2·57	+ 0·53	+ 21	23·73	− 3·40	−14	26·30	− 2·87	−11
	54. East Coast Central	2·73	− 0·82	− 30	32·46	+ 3·85	+12	35·19	+ 3·03	+ 9
	55. Do. South	4·96	− 1·52	− 31	37·46	+16·97	+45	42·42	+15·45	+36
	56. Madras South	6·30	+ 0·99	+ 16	22·57	+ 7·25	+32	28·87	+ 8·24	+29

No. 14. NUMBER OF RAINY DAYS, 1898.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
Burma	1. Tenasserim	...	...	...	...	...	...	...	...	...
	2. Lower Burma Deltaic.	...	...	...	...	...	...	...	...	...
	3. Central Burma	...	...	...	...	...	...	...	...	...
	4. Upper Do.	...	...	...	...	...	...	...	...	...
	5. Arakan	...	...	...	...	...	...	...	...	...
Bengal and Assam.	6. Eastern Bengal	21·8	−9·0	−41	73·0	+3·4	+5	94·8	−5·6	−6
	7. Assam Surma	41·9	−20·9	−50	86·2	−1·9	−2	128·1	−22·8	−18
	8. Do. Hills	36·1	−11·4	−32	93·1	−2·7	−3	129·2	−14·1	−11
	9. Do. Brahmaputra.	41·4	−6·8	−16	71·4	+0·4	+1	112·8	−6·4	−6
	10. Deltaic Bengal	16·6	−4·9	−30	63·8	+1·9	+3	80·4	−3·0	−4
	11. Central Do.	13·5	−3·6	−27	59·7	+1·1	+2	73·2	−2·5	−3
	12. North Do.	19·8	−1·7	−9	65·4	+4·7	+7	85·2	+3·0	+4
	13. Bengal Hills	28·3	−1·3	−5	92·2	−2·3	−2	120·5	−3·6	−3
	14. Orissa	11·1	−4·4	−40	62·0	−6·5	−10	73·1	−10·9	−15
	15. Chota Nagpur	10·1	−4·4	−44	59·6	−1·3	−2	69·7	−5·7	−8
	16. South Bihar	6·2	−1·3	−21	47·3	+4·3	+9	53·5	+3·0	+6
	17. North Do.	8·8	+1·2	+14	50·5	+0·1	0	59·3	+1·3	+2

No. 14. NUMBER OF RAINY DAYS, 1898—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
United Provinces of Agra and Oudh.	18. United Provinces East.	4·3	−1·1	−26	41·5	+8·5	+20	45·8	+7·4	+16
	19. South Oudh	4·2	+0·1	+2	38·5	+5·3	+14	42·7	+5·4	+13
	20. North Do.	5·2	+0·3	+6	38·8	+10·3	+27	44·0	+10·6	+24
	21. United Provinces Central.	3·8	−0·3	−8	36·8	+7·2	+20	40·6	+6·9	+17
	22. United Provinces West.	4·9	+0·9	+18	28·0	−1·8	−6	32·9	−0·9	−3
	23. United Provinces East Submontane.	5·3	−0·1	−2	42·2	+7·8	+18	47·5	+7·7	+16
	24. United Provinces West Submontane	8·9	−1·4	−16	38·4	+4·1	+11	47·3	+2·7	+6
	25. United Provinces Hills.	19·2	−6·7	−35	59·7	+8·6	+14	78·9	+1·9	+2
Punjab	26. South-East Punjab.	5·5	+1·7	+31	23·5	−3·3	−14	29·0	−1·6	−6
	27. South Punjab	5·3	+1·4	+26	16·1	−0·9	−6	21·4	+0·5	+2
	28. Central Do.	8·9	−0·2	−2	16·7	−0·4	−2	25·6	−0·6	−2
	29. Punjab Submontane.	9·9	−0·3	−3	24·9	+2·9	+12	34·8	+2·6	+7
	30. Do. Hills	22·0	−5·6	−25	48·2	+2·0	+4	70·2	−3·6	−5
	31. North Punjab	13·1	+1·7	+13	17·0	+1·4	+8	30·1	+3·1	+10
	32. West Do.	5·1	−0·2	−4	0·0	−1·6	−18	14·1	−1·8	−13
Bombay and Malabar Coast Districts (Madras).	33. Malabar	12·9	−1·2	−9	106·8	+6·0	+6	119·7	+4·8	+4
	34. Madras South Central.	9·5	+1·0	+11	36·3	+9·1	+25	45·8	+10·1	+22
	35. Mysore	6·0	+0·7	+8	41·3	+9·1	+21	53·3	+9·8	+18
	36. Konkan	3·4	+0·7	+21	96·3	+2·6	+3	99·7	+3·3	+3
	37. Bombay Deccan	5·9	+2·4	+41	49·2	+2·1	+4	55·1	+4·5	+8
	38. Hyderabad North	...	...	...	...	...	...	...	...	...
	39. Kandesh	2·3	−0·8	−35	44·2	−0·9	−2	46·5	−1·7	−4
Central Provinces and Berar.	40. Berar	...	...	...	...	...	...	...	...	...
	41. Central Provinces West.	3·5	−1·0	−29	50·3	−1·9	−4	53·8	−2·9	−5
	42. Central Provinces Central.	4·5	−1·3	−27	53·5	+6·4	+12	58·0	+5·2	+9
	43. Central Provinces East.	5·4	−2·3	−43	50·8	+3·4	+7	56·2	+1·1	+2
Bombay (North)	44. Gujarat	0·7	+1·0	+143	48·0	−7·1	−15	48·7	−6·1	−13
	45. Kathiawar and Cutch.	0·9	+0·5	+56	27·6	−1·4	−5	28·5	−0·9	−3
	46. Sind	...	...	...	...	...	...	...	...	...
	47. Baluchistan Hills.	...	...	...	...	...	...	...	...	...
Rajputana and Central India.	48. Central India East	...	...	...	...	...	...	...	...	...
	49. Rajputana East, Central India West.	...	...	...	...	...	...	...	...	...
	50. West Rajputana	...	...	...	...	...	...	...	...	...
Madras	51. East Coast North	5·9	−0·5	−8	47·8	−0·8	−2	53·7	−1·3	−2
	52. Hyderabad South	...	...	...	...	...	...	...	...	...
	53. Madras Central	4·4	+0·6	+14	34·9	+1·0	+3	39·3	+1·6	+4
	54. East Coast Central	3·3	−0·3	−9	37·6	+1·0	+3	40·9	+1·6	+4
	55. Do. South	5·8	−0·3	−5	45·6	+11·8	+26	51·4	+11·5	+22
	56. Madras South	9·3	+1·4	+15	32·3	+11·3	+35	41·6	+12·7	+31

No. 15. RAINFALL, 1899.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches.	Inches		Inches	Inches.	
Burma	1. Tenasserim	28·45	+5·68	+20	166·77	−2·82	−2	195·22	+2·86	+1
	2. Lower Burma Deltaic.	14·29	+8·78	+61	90·37	−23·11	−26	104·66	−14·33	−14
	3. Central Burma	7·83	+1·09	+14	48·65	−7·20	−15	56·48	−6·11	−11
	4. Upper Do.	6·36	+3·97	+62	31·34	+8·81	+28	37 70	+12·78	+34
	5. Arakan	14·53	+6·93	+48	158·95	+7·44	+5	173·48	+14·37	+8
Bengal and Assam.	6. Eastern Bengal	18·66	+6·05	+32	69·63	+15 26	+22	88·29	+21·31	+24
	7. Assam Surma	39·74	−1·64	−4	86·87	+11·39	+13	126 61	+9·75	+8
	8. Do. Hills	27·35	+10·16	+37	110·78	+1·52	+1	138·13	+11·68	+8
	9. Do. Brahmaputra.	26·16	+2·00	+8	61·75	+11·84	+19	87·91	+13·84	+16
	10. Deltaic Bengal	11·79	+3·89	+33	48·76	+8·78	+18	60·55	+12·67	+21
	11. Central Do.	9·01	−0·92	−10	47·27	+7·34	+16	56·28	+6·42	+11
	12. North Do.	16·59	−2·49	−15	78·11	+11·82	+15	94·70	+9·33	+10
	13. Bengal Hills	20·20	+5·08	+25	118·05	−3·80	−3	138·25	+1·22	+ 1
	14. Orissa	7 95	+2·01	+25	53·72	−9·27	−17	61·67	−7·26	−12
	15. Chota Nagpur	5·57	−0·75	−13	48·07	−7·75	−16	53 64	−8·50	−16
	16. South Bihar	3·66	+0·54	+15	40·23	+11·52	+29	43·89	+12·06	+27
	17. North Do.	5 55	+1·50	+27	46 92	+17·11	+36	52·47	+18·61	+35
United Provinces of Agra and Oudh.	18. United Provinces East.	1·90	+0·60	+32	36·39	+7·08	+19	38·29	+7·68	+20
	19. South Oudh	1·94	+0·33	+17	34·17	+3·03	+9	36 11	+3 36	+9
	20. North Do.	2 64	+0·80	+30	36·31	+3·33	+9	38·95	+4·13	+11
	21. United Provinces Central.	1·51	−0·55	−36	32·80	−0·23	−1	34·31	−0·78	−2
	22. United Provinces West.	1·92	−0·68	−35	24·41	−6·67	−27	26·33	−7·35	−28
	23. United Provinces East Submontane.	2·76	+1·45	+53	39·77	+15·66	+39	42 53	+17·11	+40
	24. United Provinces West Submontane.	4·61	−1·68	−36	41·67	−12·19	−29	46·28	−13·87	−30
	25. United Provinces Hills.	9·79	−2·52	−26	51·40	−7 58	−15	61·19	−10·10	−17
Punjab	26. South-East Punjab	2·45	−1 84	−75	21·09	−11·18	−53	23·54	−13·02	−55
	27. South Do.	2·48	−2 06	−83	13·54	−8·20	−61	16·02	−10·26	−64
	28. Central Do.	4 36	−3·00	−69	14·52	−8·21	−57	18 88	−11·21	−59
	29. Punjab Submontane.	5 59	−3 37	−60	25·71	−13 51	−53	31·30	−16·88	−54
	30. Do. Hills	14·84	−7·19	−48	46·75	−16 60	−36	61·59	−23 79	−39
	31. North Punjab	7 66	−1·52	−20	13·49	−4·05	−30	21·15	− 5·57	−26
	32. West Do.	2·38	−1 46	−61	6 45	−3·78	−59	8·83	−5·24	−59
Bombay and Malabar Coast Districts (Madras).	33. Malabar	10 23	+8·26	+81	118·39	−35·35	−30	128 62	−27·09	−21
	33-A. Travancore	...	.	...	...	..	...	...	..	...
	34. Madras South Central.	6 41	+1·49	+23	23·04	−7·56	−33	29·45	−6·07	−21
	35. Coorg	...	..	...	...	...	...	...	...	..
	36. Mysore	5·31	+2·03	+38	29 06	−7·95	−27	34·37	−5·92	−17
	37. Konkan	2·20	+2·76	+125	112 86	−59·73	−53	115 06	−56·97	−50
	38. Bombay Deccan	2·88	+1·26	+44	33 61	−16 87	−50	36·49	−15·61	−43
	39. Hyderabad North	1·73	+1·53	+88	35·46	−21·02	−59	37·19	−19·49	−52
	40. Khandesh	1·36	+0·12	+9	31·41	−19 47	−62	32·77	−19·35	−59

No. 15. RAINFALL, 1899—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches.	Inches.		Inches.	Inches.	
Central Provinces and Berar.	41. Berar	1·90	+0·16	+8	38·66	−27·91	−72	40·56	−27·75	−68
	42. Central Provinces West.	1·69	−0·22	−13	42·93	−26·41	−62	44·62	−26·63	−60
	43. Central Provinces Central.	2·01	−0·57	−28	49·57	−25·08	−51	51·58	−25·65	−50
	44. Central Provinces East.	2·74	+0·02	+1	47·29	−13·74	−29	50·03	−13·72	−27
Bombay (North).	45. Gujarat	0·40	−0·13	−33	43·63	−31·76	−73	44·03	−31·89	−72
	46. Kathiawar and Cutch.	0·51	−0·15	−29	26·56	−21·13	−80	27·07	−21·28	−79
	47. Sind	1·31	−0·60	−46	4·69	−4·63	−99	6·00	−5·23	−87
	48. Baluchistan Hills.	5·34	−1·68	−31	4·10	−3·18	−78	9·44	−4·86	−51
Rajputana and Central India.	49. Central India East	1·74	−1·13	−65	41·67	−15·25	−37	43·41	−16·38	−38
	50. Rajputana East, Central India West.	1·50	−0·89	−59	26·68	−12·56	−47	28·18	−13·44	−48
	51. West Rajputana	1·15	−0·91	−79	11·40	−9·17	−80	12·55	−10·08	−80
Madras	52. East Coast North.	3·80	+2·05	+54	36·64	−11·46	−31	40·44	−9·41	−23
	53. Hyderabad South	2·51	−0·32	−13	26·95	−12·97	−48	29·46	−13·29	−45
	54. Madras Central	2·58	+1·06	+41	24·00	−9·75	−41	26·58	−8·69	−33
	55. East Coast Central	2·72	+0·96	+35	32·47	−10·56	−33	35·19	−9·60	−27
	56. Do. South	4·98	+2·67	+54	37·52	−7·64	−20	42·50	−4·97	−12
	57. Madras South	6·31	+3·99	+63	22·27	−6·72	−30	28·58	−2·73	−10

No. 16. NUMBER OF RAINY DAYS, 1899.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.
Burma	1. Tenasserim	...	...	...	...	...	...	...	...	...
	2. Lower Burma Deltaic.	...	...	...	...	...	...	...	...	...
	3. Central Burma	...	...	...	...	...	...	...	...	...
	4. Upper Do.	...	...	...	...	...	...	...	...	...
	5. Arakan	...	...	...	...	...	...	...	...	...
Bengal and Assam.	6. Eastern Bengal	21·9	+5·3	+26	73·3	+7·3	+10	95·2	+13·1	+14
	7. Assam Surma	41·7	+2·8	+7	85·3	+7·4	+9	127·0	+10·2	+8
	8. Do. Hills	36·1	+4·0	+11	93·2	+4·2	+5	129·3	+8·2	+6
	9. Do. Brahmaputra.	41·3	−0·4	−1	70·7	+10·1	+14	112·0	+9·7	+9
	10. Deltaic Bengal	16·5	+4·1	+25	63·8	−1·8	−3	80·3	+2·3	+3
	11. Central Do.	13·4	+0·8	+6	59·9	−0·2	0	73·3	+0·6	+1
	12. North Do.	19·8	−0·8	−4	65·3	+11·4	+17	85·1	+10·6	+12
	13. Bengal Hills	28·7	+8·8	+31	92·4	+7·4	+8	121·1	+16·2	+13
	14. Orissa	11·1	+3·8	+34	61·5	−9·3	−15	72·6	−5·5	−8
	15. Chota Nagpur	9·6	+0·1	+1	60·6	−11·2	−18	70·2	−11·1	−16
	16. South Bihar	6·1	+1·7	+28	47·4	+2·7	+6	53·5	+4·4	+8
	17. North Do.	8·8	+2·3	+26	50·0	+8·6	+17	58·8	+10·9	+19

No. 16. NUMBER OF RAINY DAYS, 1899—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole year.		
		Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.	Average normal.	Variation of actual from normal.	Percentage variation from normal.
United Provinces of Agra and Oudh.	18. United Provinces East.	4·3	+0·5	+12	41·5	+1·4	+3	45·8	+1·9	+4
	19 South Oudh .	4·2	+0·2	+5	38·5	+0·3	+1	42·7	+0·5	+1
	20. North Do.	5·2	+2·1	+40	38·8	+3·9	+10	44·0	+6·0	+14
	21 United Provinces Central	3·8	−1·1	−29	36·7	−3·4	−9	40·5	−4·5	−11
	22. United Provinces West.	4·9	−1·7	−35	28·0	−4·9	−18	32·9	−6·6	−20
	23. United Provinces East Submontane.	5·3	+3·1	+58	42·2	+7·6	+18	47·5	+10·7	+23
	24. United Provinces West Submontane	8·9	−2·1	−24	38·4	−5·0	−13	47·3	−7·1	−15
	25. United Provinces Hills.	19·2	−4·2	−22	59·7	−11·2	−19	78·9	−15·4	−20
Punjab . .	26. South-East Punjab	5·5	−3·5	−64	23·5	−7·5	−32	29·0	−11·0	−38
	27. South Do. .	5·3	−3·8	−72	16·1	−6·9	−43	21·4	−10·7	−50
	28 Central Do. .	8·9	−4·8	−54	16·7	−6·7	−40	25·6	−11·5	−45
	29. Punjab Submontane.	9·9	−4·4	−44	25·5	−7·3	−29	35·4	−11·7	−33
	30 Do. Hills .	22·0	−3·9	−18	47·8	12·1	−25	69·8	−16·0	−23
	31. North Punjab .	13·2	+0·4	+3	17·0	−1·6	−9	30·2	−1·2	−4
	32. West Punjab	5·3	−2·6	−49	9·0	−4·5	−50	14·3	−7·1	−50
Bombay and Malabar Coast Districts (Madras).	33 Malabar . .	12·9	+8·7	+67	107·6	−35·0	−33	120·5	−26·3	−22
	33-A. Travancore .	...	...	...	...	...	...	...	...	...
	34. Madras South Central.	9·6	+2·2	+23	36·3	−11·9	−33	45·9	−9·7	−21
	35. Coorg . .	...	..	..	...	.	...	...	...	...
	36. Mysore . .	9·0	+2·5	+28	43·8	−10·4	−24	52·8	−7·9	−15
	37. Konkan . .	3·4	+2·6	+76	95·7	−30·0	−31	99·1	−27·4	−28
	38. Bombay Deccan .	5·9	+0·7	+12	49·0	−19·7	−40	54·9	−19·0	−35
	39 Hyderabad North	...	...	...	..	..	..	..	...	...
	40. Khandesh . .	2·3	+0·9	+39	44·3	−23·0	−5	46·6	−22·1	−47
Central Provinces and Berar.	41. Berar . . .	...	...	..	...	...	..	...	...	...
	42. Central Provinces West.	3·7	+0·5	+14	50·3	−24·9	−50	54·0	−24·4	−45
	43. Do. Central	4·4	−0·1	−2	53·5	−22·0	−41	57·9	−22·1	−38
	44. Do East .	5·3	+1·4	+26	50·6	−10·5	−21	55·9	−9·1	−16
Bombay (North)	45. Gujarat . .	0·7	0	0	48·2	−31·5	−65	48·9	−31·5	−64
	46. Kathiawar and Cutch.	0·8	0	0	27·5	−19·2	−70	28·3	−19·2	−68
	47. Sind . . .	...	...	...	...	...	...	...	...	...
	48. Baluchistan Hills.	...	..	...	...	...	...	...	...	...
Rajputana and Central India	49. Central India East	...	...	...	...	...	...	...	...	...
	50 Rajputana East, Central India West.	...	...	...	...	..	...	...	...	...
	51. West Rajputana .	...	...	...	...	...	...	...	...	...
Madras . .	52 East Coast North .	6·0	+2·3	+38	47·6	−12·1	−25	53·6	−9·8	−18
	53. Hyderabad South .	...	...	...	...	...	...	...	...	...
	54. Madras Central .	4·4	+2·7	+61	35·0	−12·5	−36	39·4	−9·8	−25
	55. East Coast Central	3·3	+1·4	+42	37·6	−12·2	−32	40·9	−10·8	−26
	56. Do. South.	5·8	+4·5	+78	46·2	−13·0	−28	52·0	−8·5	−16
	57. Madras South .	9·3	+3·3	+35	31·9	−8·6	−27	41·2	−5·3	−13

No. 17. RAINFALL, 1900

Province	Division	Dry Season, January to May: Average normal.	Dry Season, January to May: Variation from normal	Dry Season, January to May: Percentage variation	Wet Season, June to December: Average normal	Wet Season, June to December: Variation from normal.	Wet Season, June to December: Percentage variation from normal	Whole Year: Average normal.	Whole Year: Variation from normal	Whole Year: Percentage variation from normal
		Inches	Inches		Inches	Inches		Inches	Inches.	
Burma	1 Tenasserim	28 45	—8 59	— 30	166 77	+ 6 32	+ 4	195 22	—2 27	— 1
	2 Lower Burma Delta.	14 29	—5 41	— 38	90 37	+ 9 52	+11	104 66	+4 11	+ 4
	3 Central Burma	7 83	—3 80	— 49	48 65	+10 75	+22	56 48	+ 6 95	+12
	4 Upper Do	6 36	—0·74	— 12	31 34	+ 8 62	+27	37 70	+ 7 88	+21
	5 Arakan	14 53	—9 47	— 65	158 95	—10·00	— 6	173 48	—19 47	—11
Bengal and Assam.	6 Eastern Bengal	18 75	—3 82	— 20	69 89	— 3 29	— 5	88 64	— 7 11	— 8
	7 Assam Surma	41 00	+2 56	+ 6	92·61	—26·69	—29	133 61	—24 13	—18
	8. Do Hills	29 30	—1 18	— 4	96 26	—26 82	—28	125 56	—28 00	—22
	9 Do Brahmaputra	25·69	—0 13	— 1	74·01	— 9 96	—13	99 70	—10 09	—10
	10 Deltaic Bengal	11 82	—0·65	— 5	48 76	+17 16	+35	60 58	+16 51	+27
	11 Central do	9 01	—0 98	— 11	47 26	+ 0·57	+ 1	56 27	— 0 41	— 1
	12 North do	16 51	—3 95	— 24	78 53	—14 54	—19	95 04	—18 49	—19
	13 Bengal Hills	20 6.	—7 10	— 34	116 92	—29 69	—25	137 56	—36 79	—27
	14 Orissa	7 96	—0 48	— 6	51 60	+12 35	+24	59 76	+11 87	+20
	15 Chota Nagpur	5·72	+1·53	+ 27	48 28	+ 3 72	+ 8	54 00	+ 5·25	+10
	16 South Bihar	2 66	+1 22	+ 33	40 20	— 3 33	— 8	43 86	— 2 13	— 5
	17 North do	5 62	—0 74	— 4	48 00	— 0 80	— 2	53 68	— 1 04	— 2
United Provinces of Agra and Oudh	18 United Provinces East	1 90	+2·39	+126	36 35	— 3 73	—10	38 25	— 1 34	— 4
	19 South Oudh	1·94	+1 59	+ 82	34 16	— 1 43	— 4	36 10	+ 0 16	0
	20 North do	2 64	+0·87	+ 33	36 31	— 1 15	— 3	38 95	— 0·28	— 1
	21 United Provinces Central	1 49	+0·47	+ 32	32 80	— 3 67	—11	34 29	— 3 20	— 9
	22 United Provinces West.	1 92	—0·42	— 22	24 41	+ 0 81	+ 3	26·33	+ 0 39	+ 1
	23 United Provinces East Submontane	2 73	+2 88	+105	39 77	— 1 46	— 4	42 50	+ 1 42	+ 3
	24 United Provinces West Submontane	4·63	+0 50	+ 11	41 73	— 1 12	— 3	46 36	— 0 62	— 1
	25 United Provinces Hills	9·79	+2 84	+ 29	51 40	— 3 74	— 7	61 19	— 0 90	— 1
Punjab	26 South East Punjab	2 45	—0·33	— 13	21 01	+ 5 42	+26	23 54	+ 5 09	+22
	27 South Punjab	2 48	—0·88	— 35	13 52	+ 2 47	+55	16 00	+ 0 59	+41
	28 Central do	4 36	—1 34	— 31	14 51	+ 1 72	+12	18 87	+ 0 38	+ 2
	29 Punjab Submontane	5 59	—0·71	— 13	25 27	+13 26	+52	30 86	+12 55	+41
	30 Punjab Hills	15·08	—0·77	— 5	47·06	+10 93	+23	62 14	+10·16	+16
	31 North Punjab	7 79	+2 20	+ 28	13 49	+ 3 04	+23	21 28	+ 5 24	+25
	32 West Punjab	2 38	+0·20	+ 8	6 52	— 1 11	—17	8 90	— 0·91	—10
Bombay and Malabar Coast Districts (Madras)	33 Malabar	11 32	—5·11	— 45	113 75	+15·93	+14	125 07	+10 82	+ 9
	33 A Travancore				22 93	—1 59	— 7	29 33	— 0 83	— 3
	34. Madras South Central	6 40	+0·76	+ 12						
	35 Coorg				29 10	+ 6 24	+21	34 46	+ 4 71	+14
	36 Mysore	5·36	—1 53	— 29	112 97	+ 0 86	+ 1	115 19	— 0 98	— 1
	37 Konkan	2 22	—1 84	— 83	33 10	— 1 62	— 5	35 99	— 2 74	— 8
	38 Bombay Deccan	2 89	—1 11	— 39	34 27	— 2 84	— 8	35 86	— 3 26	— 9
	39 Hyderabad North	1 59	—0 42	— 26	34 27	— 2 84	— 8	35 86	— 3 26	— 9
	40. Khandesh	1 36	—1 27	— 93	31 41	— 3 06	—10	32 77	— 4 33	—13
Central Provinces and Berar	41 Berar	1 90	—1 53	— 81	38 66	— 7 01	—18	40 56	— 8 54	—21
	42 Central Provinces West	1·72	—0 88	— 51	42 95	+ 2 82	+ 7	44 67	+ 1 94	+ 4
	43 Central Provinces Central	2·04	+0 07	+ 3	49 49	+ 2 81	+ 6	51 53	+ 2 88	+ 6
	44 Central Provinces East	2 76	+0·87	+ 32	47 32	+12 91	+27	50 08	+13 78	+28

No. 17. RAINFALL, 1900—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
		Inches	Inches		Inches.	Inches.		Inches.	Inches.	
Bombay (North)	45. Gujarat	0·40	−0·06	− 15	43·81	− 9·29	−21	44·21	− 9·35	−21
	46. Kathiawar and Cutch.	0·51	+0·05	+ 10	27·68	+ 1·15	+ 4	28·19	+ 1·20	+ 4
	47. Sind	1·31	−1·03	− 79	4·69	− 0·59	−13	6·00	− 1·62	−27
	48. Baluchistan Hills.	5·25	−1·19	− 23	4·13	+ 1·95	+47	9·38	+ 0·76	+ 8
Rajputana and Central India.	49. Central India East.	1·71	−0·69	− 40	41·20	− 3·51	− 9	42·91	− 4·20	−10
	50. Rajputana East, Central India West	1·50	−0·23	− 15	26·68	+ 3·14	+12	28·18	+ 2·91	+10
	51. West Rajputana	1·15	−0·34	− 30	11·38	+ 1·57	+14	12·53	+ 1·23	+10
Madras	52. East Coast North	3·90	+0·80	+ 21	37·62	− 5·55	−15	41·52	− 4·75	−11
	53. Hyderabad South.	2·48	−1·00	− 40	27·48	− 2·68	−10	29·96	− 3·68	−12
	54. Madras Central	2·58	+0·02	+ 1	22·26	− 3·52	−16	24·84	− 3·50	−14
	55. East Coast Central	2·47	+0·10	+ 4	30·70	− 8·46	−28	33·17	− 8·36	−25
	56. East Coast South	4·30	+1·00	+ 23	37·27	− 6·07	−16	41·57	− 5·07	−12
	57. Madras South	6·33	+2·10	+ 33	22·21	+ 2·65	+12	28·54	+ 4·75	+17

No. 18. NUMBER OF RAINY DAYS, 1900.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
Burma	1 Tenasserim	...	...	...	...	...	...	...	...	...
	2 Lower Burma Deltaic.									
	3 Central Burma	...	...	...	...	...	...	...	...	...
	4 Upper do.	...	...	...	...	...	...	...	...	...
	5 Arakan	...	...	...	...	...	...	...	...	...
Bengal and Assam.	6 Eastern Bengal	21·9	−0·1	0	73·3	− 6·2	− 8	95·2	− 6·3	− 7
	7 Assam Surma	39·9	+7·9	+20	90·6	−19·7	−22	130·5	−11·8	− 9
	8 Do. Hills	33·3	+4·1	+12	89·2	−10·3	−12	122·5	− 6·2	− 5
	9 Do. Brahmaputra.	37·5	+3·0	+ 8	75·0	− 9·1	−12	112·5	− 6·1	− 5
	10 Deltaic Bengal	16·3	+2·5	+15	63·8	+ 0·6	+ 1	80·1	+ 3·1	+ 4
	11 Central do.	13·3	+1·0	+ 8	59·7	− 1·0	− 2	73·0	− 0·9	− 1
	12 North do.	10·8	−1·8	− 9	65·4	− 5·3	− 9	85·2	− 7·6	− 9
	13 Bengal Hills	28·5	−1·6	− 6	91·3	−10·1	−11	119·8	−11·7	−10
	14 Orissa	11·1	+2·8	+25	61·5	− 1·2	− 2	72·6	+ 1·6	+ 2
	15 Chota Nagpur	9·9	+3·9	+39	59·5	+ 1·1	+ 2	69·4	+ 5·0	+ 7
	16 South Bihar	6·2	+3·6	+58	47·1	− 0·9	− 2	53·3	+ 2·7	+ 5
	17 North do.	8·9	+1·1	+12	50·9	− 1·9	− 4	59·8	− 0·8	− 1

No 18. NUMBER OF RAINY DAYS, 1900—*concluded*

Province.	Division	Dry Season, January to May			Wet Season June to December.			Whole Year		
		Average normal	Variation from normal	Percentage variation from normal	Average normal	Variation from normal	Percentage variation from normal	Average normal	Variation from normal	Percentage variation from normal
United Provinces of Agra and Oudh	18 United Provinces East	4·3	+3·9	+91	41·5	+ 2·0	+ 5	45·8	+ 5·9	+13
	19 South Oudh	4·2	+2·1	+50	38·5	+ 1·5	+ 4	42·7	+ 3·6	+ 8
	20 North Do	5·2	+2·0	+38	38·8	+ 0·6	+ 2	44·0	+ 2·6	+ 6
	21 United Provinces Central	3·8	+1·2	+32	36·8	+ 4·9	+13	40·6	+ 6·1	+15
	22 United Provinces West	4·9	+0·1	+ 2	28·0	+ 7·0	+25	32·9	+ 7·1	+22
	23 United Provinces East Submontane	5·3	+3·8	+72	42·2	+ 0·5	+ 1	47·5	+ 4·3	+ 9
	24 United Provinces West Submontane.	8·9	+1·6	+18	38·4	+ 5·6	+15	47·3	+ 7·2	+15
	25 United Provinces Hills	19·2	+0·6	+ 3	59·7	− 0·6	− 1	78·9	0	0
Punjab	26 South East Punjab	5·5	+0·2	+ 4	23·5	+ 9·1	+39	29·0	+ 9·3	+32
	27 South Do	5·3	−0·3	− 6	16·0	+ 5·5	+34	21·3	+ 5·2	+24
	28 Central Do	8·9	+0·5	+ 6	16·7	+ 2·8	+17	25·6	+ 3·3	+13
	29 Punjab Submontane	9·8	+1·7	+17	24·9	+ 7·8	+31	34·7	+ 9·5	+27
	30 Do Hills	22·1	+7·4	+33	48·2	+ 7·9	+16	70·3	+15·3	+22
	31 North Punjab	13·2	+9·8	+74	17·0	+ 7·0	+41	30·2	+16·8	+56
	32 West Punjab	5·3	+1·9	+36	9·0	+ 1·0	+11	14·3	+ 2·9	+20
Bombay and Malabar Coast Districts (Madras)	33 Malabar	14·1	−6·5	−46	104·0	− 0·7	− 1	118·1	− 7·2	− 6
	33-A Travancore									
	34 Madras South Central	9·9	+0·3	+ 3	36·0	+ 1·1	+ 3	45·9	+ 1·4	+ 3
	35 Coorg									
	36 Mysore	9·0	−2·8	−31	44·3	+ 2·7	+ 6	53·3	− 0·1	0
	37 Konkan	3·4	−2·5	−74	96·3	− 9·8	−10	99·7	−12·3	−12
	38 Bombay Deccan	5·9	−1·9	−32	48·2	− 8·6	−18	54·1	−10·5	−19
	39 Hyderabad North									
	40 Khandesh	2·3	−2·1	−91	41·3	− 6·3	−14	46·6	− 8·4	−18
Central Provinces and Berar	41 Berar									
	42 Central Provinces West	2·6	−0·8	−31	50·3	− 0·8	− 2	52·9	− 1·6	− 3
	43 Central Provinces Central	4·5	+0·1	+ 2	53·5	+ 3·	+ 7	58·0	+ 3·8	+ 7
	44 Central Provinces East	5·4	+3·7	+69	50·8	+12·6	+25	56·2	+16·3	+29
Bombay (North)	45 Gujarat	0·7	+0·2	+29	48·4	−13·3	−27	49·1	−13·1	−27
	46 Kathiawar and Cutch	0·8	+0·2	+25	27·6	− 1·4	− 5	28·4	− 1·2	− 4
	47 Sind									
	48 Baluchistan Hills									
Rajputana and Central India	49 Central India East									
	50 Rajputana East, Central India West									
	51 West Rajputana									
Madras	52 East Coast North	6·3	+1·0	+16	49·1	− 4·0	− 8	55·4	− 3·0	−5
	53 Hyderabad South									
	54 Madras Central	4·7	−0·1	− 2	34·7	− 1·4	− 4	39·4	− 1·5	− 4
	55 East Coast Central	3·8	−0·7	−18	37·7	− 0·6	− 2	41·5	− 1·3	− 3
	56 East Coast South	6·4	+0·8	+13	45·5	− 2·2	− 5	51·9	− 1·4	− 3
	57 Madras South	9·4	+2·0	+21	31·4	+ 5·5	+18	40·8	+ 7·5	+18

No. 19. RAINFALL, 1901.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches	Inches.		Inches	Inches.	
Burma	1. Tenasserim	28 45	— 7 39	— 26	166·77	+ 5·11	+ 3	195·22	— 2·28	— 1
	2. Lower Burma Deltaic	14 29	— 0·66	— 5	90·37	— 3 29	— 4	104·66	— 3·95	— 4
	3. Central Burma	7·83	— 0·60	— 8	48 05	+ 0 66	+ 1	56 48	+ 0·06	0
	4. Upper Do.	6·36	+ 1·19	+ 19	31·24	+ 3·95	+13	37 70	+ 5 14	+14
	5 Arakan	14·53	— 3 14	— 22	158 95	+ 3·08	+ 2	173·48	— 0·06	0
Bengal and Assam.	6 Eastern Bengal	18·77	— 7.02	— 37	70·47	+11 99	+17	89·24	+ 4·97	+ 6
	7. Assam Surma	41·10	—16·27	— 40	93 07	— 1·09	— 1	134·07	—17·36	—13
	8. Do. Hills	29·30	— 9 47	— 32	106·11	— 9·56	— 9	135·41	—19·03	—14
	9. Do. Brahmaputra	25·59	— 9·13	— 36	64·29	+ 1·41	+ 2	89·88	— 7·72	— 9
	10. Deltaic Bengal	11·81	+ 0·27	+ 2	48·75	+ 2 44	+ 5	60·56	+ 2·71	+ 4
	11. Central Do.	8·99	— 0·56	— 6	47·14	— 4·55	—10	56 13	—5·11	— 9
	12. North Do.	16·84	— 6·19	— 37	80·08	—11 06	—14	96 92	—17·25	—18
	13. Bengal Hills	20 01	— 6 83	— 34	111·87	—26 52	—24	131·88	—33·35	—25
	14. Orissa	7·96	+ 1·53	+ 19	51·12	— 8·11	—16	59·08	— 6·58	—11
	15 Chota Nagpur	5·49	+ 3 41	+ 63	48·10	— 6·58	—14	53·59	— 3·14	— 6
	16. South Bihar	3 67	+ 2 10	+ 57	40·07	—10 54	—26	43 74	— 8·44	—19
	17. North Do.	5·57	+ 0·30	+ 5	47·76	—16 00	—34	53 27	—15·70	—29
United Provinces of Agra and Oudh.	18. United Provinces East	1·90	+ 3·29	+173	36 35	— 5 34	—15	38·25	— 2·05	— 5
	19. South Oudh	1·94	+ 1·85	+ 95	34·16	— 5 60	—16	36·10	— 3·75	—10
	20. North Do.	2·64	+ 1·73	+ 66	36 31	— 9·71	—27	38 95	— 7·98	—20
	21. United Provinces Central.	1·51	+ 1·72	+114	32·80	— 4·90	—15	34·31	— 3·18	— 9
	22. United Provinces West.	1·92	+ 0·70	+ 36	24·41	— 7·69	—32	26·33	— 6·99	—27
	23. United Provinces East Submontane	2 75	+ 2·71	+ 99	39·95	— 9 85	—25	42 70	— 7·14	—17
	24. United Provinces West Submontane.	4·62	+ 1·98	+ 43	41·75	— 2·70	— 6	46·37	— 0·72	— 2
	25. United Provinces Hills.	10·25	+ 1 01	+ 10	50 80	+ 3·27	+ 6	61·05	+ 4·28	+ 7
Punjab	26. South-East Punjab	2 42	+ 0·61	+ 25	21·09	— 8·11	—38	23·51	— 7·50	—32
	27. South Do.	2·48	+ 0·34	+ 14	13·54	— 5·46	—40	16·02	— 5·12	—32
	28. Central Do.	4·36	+ 1 28	+ 29	14 51	— 4 51	—31	18 87	— 3·23	—17
	29. Punjab Submontane.	5·60	+ 3·18	+ 57	25·13	— 4 38	—17	30 73	— 1·20	— 4
	30. Punjab Hills	15 05	+ 5·20	+ 35	47·49	— 5·38	—11	62·54	+ 0·18	0
	31. North Punjab	8·18	+ 7·13	+ 87	13·63	— 3·54	—26	21 81	+ 3 59	+16
	32. West Punjab	2·38	+ 1·41	+ 59	6 55	— 2 74	—42	8·93	— 1·33	—15
Bombay and Malabar Coast Districts (Madras).	33. Malabar	11·39	— 0·34	— 3	114·13	+ 9 00	+ 8	125·52	+ 8·66	+ 7
	33-A. Travancore	...	...	...	...	...	...	...	...	...
	34. Madras South Central.	6·36	+ 0·35	+ 6	23·20	+ 2·31	+10	29·56	+ 2·66	+ 9
	35. Coorg	...	...	...	...	...	...	...	...	...
	36. Mysore	5·36	+ 1·68	+ 31	29·11	+ 1·68	+ 6	34·47	+ 3·36	+10
	37. Konkan	2·22	+ 0·13	+ 6	112·86	— 9·85	— 9	115 08	— 9·72	— 8
	38. Bombay Deccan	2·88	+ 3·12	+108	33 71	— 5·92	—18	36 59	— 2·80	— 8
	39. Hyderabad North	1·59	+ 3·55	+223	35·27	— 5·15	—15	36·86	— 1·60	— 4
	40. Khandesh	1·36	+ 0·70	+ 51	31·41	— 7·57	—24	32·77	— 6 87	—21
Central Provinces and Berar.	41. Berar	1·90	+ 1·71	+ 90	38·66	— 6·25	—16	40 56	— 4·54	—11
	42. Central Provinces West.	1·72	+ 2·47	+144	42 95	— 5 37	—13	44 67	— 2·90	— 6
	43. Central Provinces Central.	2 03	+ 3·57	+176	49·60	+ 0·22	0	51·63	+ 3·79	+ 7
	44. Central Provinces East.	2·76	+ 5·13	+186	47·32	— 4·31	— 9	50·08	+ 0·82	+ 2

No. 29. RAINFALL, 1901—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches.	Inches.		Inches.	Inches.	
Bombay (North).	45. Gujarat	0·40	+ 0·03	+ 13	43·63	−18·37	−42	44·03	−18·32	−42
	46. Kathiawar and Cutch.	0·51	− 0·20	− 39	27·68	−15·37	−36	28·19	−15·57	−55
	47. Sind	1·31	− 0·45	− 34	4·69	− 3·32	−71	6·00	− 3·77	−63
	48. Baluchistan Hills.	5·52	− 0·95	− 17	4·03	− 2·71	−67	9·57	− 3·67	−38
Rajputana and Central India.	49. Central India East	1·71	+ 0·43	+ 25	40·80	− 9·14	−22	42·51	− 8·71	−20
	50. Rajputana East, Central India West.	1·50	+ 1·21	+ 14	26·70	−10·90	−41	28·20	−10·69	−38
	51. West Rajputana	1·15	− 0·63	− 55	11·43	− 5·38	−47	12·58	− 6·01	−48
Madras.	52. East Coast North.	4·11	− 3·31	− 80	37·00	− 5·10	−13	42·01	− 1·80	− 4
	53. Hyderabad South	2·48	+ 4·32	+177	27·48	− 6·64	−24	29·96	− 2·36	− 8
	54. Madras Central	2·58	+ 2·72	+106	32·24	− 5·02	−23	34·82	− 3·29	− 9
	55. East Coast Central	2·40	+ 2·27	+ 92	31·30	+ 1·16	+ 4	33·18	+ 3·43	+10
	56. East Coast South.	4·31	+ 1·58	+ 37	37·23	+ 0·51	+ 1	41·55	+ 2·09	+ 5
	57. Madras South	6·33	+ 3·04	+ 48	33·24	− 0·11	0	39·57	+ 2·95	+10

No. 20. NUMBER OF RAINY DAYS, 1901—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
United Provinces of Agra and Oudh.	18. United Provinces East.	4·3	+ 5·2	+121	41·5	— 7·7	—19	45·8	— 2·5	— 5
	19. South Oudh .	4·2	+ 4·8	+114	38·6	— 9·4	—24	42·8	— 4·6	—11
	20 North Do. .	5·2	+ 3·9	+ 75	38·8	— 7·6	—20	44·0	— 3·7	— 8
	21. United Provinces Central.	3·8	+ 3·9	+·03	36·8	— 8·0	—22	40·6	— 4·1	—10
	22. United Provinces West.	4·9	+ 1·5	+ 31	28·1	— 5·6	—20	33·0	— 4·1	—12
	23. United Provinces East Submontane.	5·3	+ 4·3	+ 81	42·1	— 6·6	—16	47·4	— 2·3	— 5
	24. United Provinces West Submontane.	8·9	+ 3·8	+ 43	38·4	— 3·4	— 9	47·3	+ 0·4	+ 1
	25 United Provinces Hills.	20·2	— 3·7	— 18	60·8	—10·1	—17	81·0	—13·8	—17
Punjab . .	26. South-East Punjab	5·5	+ 3·3	+ 60	23·5	— 6·6	—28	29·0	— 3·3	—11
	27. South Do.	5·3	+ 1·9	+ 36	16·1	— 4·8	—30	21·4	— 2·9	—14
	28. Central Do.	8·9	+ 0·3	+ 3	16·7	— 4·0	—24	25·6	— 3·7	—14
	29. Punjab Submontane.	9·8	+ 4·4	+ 45	24·9	— 4·5	—18	34·7	— 0·1	0
	30. Punjab Hills .	21·9	+ 2·5	+ 11	48·2	— 7·8	—16	70·1	— 5·3	— 8
	31. North Punjab .	13·2	+ 6·4	+ 47	17·1	— 2·2	—13	30·3	+ 4·0	+13
	32. West Punjab .	5·3	+ 1·2	+ 23	9·2	— 3·2	—35	14·5	— 2·0	—14
Bombay and Malabar Coast Districts (Madras).	33. Malabar . .	14·0	+ 2·9	+ 21	103·8	+ 3·2	+ 3	117·8	+ 6·1	+ 5
	33-A. Travancore .	...	...	...	..	...	...	...	...	...
	34. Madras South Central.	10·0	— 0·4	— 4	36·4	+ 1·0	+ 3	46·4	+ 0·6	+ 1
	35. Coorg . .	...	...	...	...	...	...	...	...	...
	36. Mysore . .	9·0	+ 2·6	+ 29	44·3	+ 4·1	+ 9	53·3	+ 6·7	+13
	37. Konkan . .	3·4	0	0	96·3	— 8·0	— 8	99·7	— 8·6	— 8
	38. Bombay Deccan .	5·9	+ 5·0	+ 85	49·2	— 6·3	—13	55·1	— 1·3	— 2
	39 Hyderabad North	...	...	...	...	...	...	...	...	...
	40. Khandesh . .	2·3	+ 2·0	+ 87	44·3	— 5·7	—13	46·6	— 3·7	— 8
Central Provinces and Berar.	41. Berar . . .	...	..	...	...	...	...	...	...	...
	42. Central Provinces West.	3·5	+6·7	+191	50·3	— 5·2	—10	53·8	+ 1·5	+ 3
	43. Central Provinces Central.	4·5	+8·1	+180	53·5	— 1·5	— 3	58·0	+ 6·6	+11
	44. Central Provinces East.	5·4	+10·9	+202	50·8	+ 0·8	+ 2	56·2	+11·7	+21
Bombay (North).	45. Gujarat . .	0·7	+0·3	+ 43	48·4	—17·3	—36	49·1	—17·0	—35
	46. Kathiawar and Cutch	0·8	+ 0·1	+ 13	27·7	— 8·8	—32	28·5	— 8·7	—31
	47. Sind . . .	...	...	...	...	...	...	...	...	...
	48. Baluchistan Hills .	...	...	...	...	...	...	...	...	...
Rajputana and Central India.	49 Central India East	...	...	...	...	...	...	...	...	...
	50. Rajputana East, Central India West	...	...	...	...	...	...	...	...	...
	51. West Rajputana .	...	...	....	...	...	...	...	...	...
Madras . .	52. East Coast North	6·7	+ 4·6	+ 69	49·6	— 3·2	— 6	56·3	+ 1·4	+ 2
	53. Hyderabad South	...	...	...	...	...	...	...	...	...
	54. Madras Central .	4·6	+ 4·5	+ 98	31·8	— 1·2	— 3	39·4	+ 3·3	+ 8
	55 East Coast Central	3·8	+ 3·3	+87	37·4	+ 3·7	+10	41·2	+ 7·0	+17
	56 East Coast South .	6·1	+ 3·1	+ 51	45·6	+ 0·9	+ 2	51·7	+ 4·0	+ 8
	57. Madras South .	9·9	+ 5·2	+ 53	31·2	— 0·2	— 1	41·1	+ 5·0	+12

No. 21. RAINFALL, 1902.

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal	Average normal	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches.	Inches.		Inches.	Inches.	
Burma	1. Tenasserim	28·45	+4·35	+15	166·77	−11·37	−7	195·22	−7·02	−4
	2. Lower Burma Deltaic.	14·29	+2·05	+19	90·37	−9·30	−10	104·66	−6·65	−6
	3. Central Burma	7·83	+1·22	+16	48·65	+0·39	+1	56·48	+1·61	+3
	4. Upper Do.	7·67	−1·51	−20	34·01	+2·70	+8	41·68	+1·25	+3
	5. Arakan	14·53	−3·32	−23	158·95	−3·50	−2	173·48	−6·82	−4
Bengal and Assam.	6. Eastern Bengal	18·42	+9·97	+54	71·87	+8·36	+12	90·29	+18·33	+20
	7. Assam Surma	41·48	−1·00	−2	92·14	−2·24	−2	133·62	−3·24	−2
	8. Do. Hills	29·15	−2·15	−7	106·20	+0·37	0	135·35	−1·78	−1
	9. Do. Brahmaputra.	25·88	−1·62	−6	66·10	+8·50	+13	91·98	+6·88	+7
	10. Deltaic Bengal	11·34	+0·68	+59	49·85	−4·22	−8	61·19	+2·46	+4
	11. Central Do.	7·90	+2·39	+30	48·54	−2·09	−4	56·53	+0·30	+1
	12. North Do.	16·92	+3·63	+21	82·84	+12·45	+15	99·74	+16·08	+16
	13. Bengal Hills	10·06	+0·75	+5	93·72	+27·70	+30	100·78	+28·58	+26
	14. Orissa	7·10	+0·41	+6	51·27	−4·56	−8	58·37	−3·65	−6
	15. Chota Nagpur	5·11	−0·75	−15	45·30	−3·64	−8	50·41	−4·59	−9
	16. South Bihar	3·45	−1·44	−42	41·57	−5·06	−12	45·02	−6·50	−14
	17. North Do.	5·38	+0·57	+11	48·17	−2·87	−6	53·55	−2·30	−4
United Provinces of Agra and Oudh.	18. United Provinces East.	2·05	−1·00	−49	37·78	−1·70	−4	39·83	−2·70	−7
	19. South Oudh	2·04	−1·49	−73	35·60	−5·63	−16	37·64	−7·12	−19
	20. North Do.	2·61	−1·20	−43	39·28	−2·35	−6	42·09	−3·55	−8
	21. United Provinces Central.	1·70	−0·99	−58	33·06	−5·85	−18	34·76	−6·84	−20
	22. United Provinces West.	2·03	−1·80	−89	23·07	−0·03	0	25·10	−1·83	−7
	23. United Provinces East Submontane.	2·91	−0·76	−26	42·44	−4·78	−11	45·38	−5·54	−12
	24. United Provinces West Submontane.	4·49	−2·48	−55	43·10	−5·05	−12	47·59	−7·56	−16
	25. United Provinces Hills.	9·46	−4·05	−43	54·33	−6·21	−11	63·79	−10·26	−16
Punjab	26. South-East Punjab	2·45	−1·55	−63	20·24	−1·46	−7	22·69	−3·01	−13
	27. South Do.	2·47	−1·13	−46	13·50	−3·22	−24	15·97	−4·35	−27
	28. Central Do.	4·30	−2·53	−58	14·35	−1·25	−9	18·61	−3·78	−20
	29. Punjab Submontane.	5·02	−3·04	−54	24·14	−6·70	−28	29·76	−9·74	−33
	30. Punjab Hills	15·04	−5·04	−34	45·35	−14·45	−32	60·29	−19·49	−32
	31. North Punjab	6·26	−3·48	−42	16·34	+0·13	+1	22·60	−3·35	−15
	32. West Do.	2·61	−1·33	−51	6·57	−0·60	−9	9·18	−1·93	−21
Bombay and Malabar Coast Districts (Malabar).	33. Malabar	11·31	−3·63	−32	114·16	+22·07	+19	125·50	+18·44	+15
	33A. Travancore	...	...	...	...	...	...	...	...	...
	34. Madras South Central.	6·38	+1·82	+29	23·06	+4·60	+20	29·44	+6·42	+22
	35. Coorg	...	...	...	...	...	...	...	...	...
	36. Mysore	5·36	+0·71	+13	29·18	+3·97	+14	34·54	+4·68	+14
	37. Konkan	2·17	−1·54	−71	110·97	−5·01	−5	113·14	−6·55	−6
	38. Bombay Deccan	3·28	−1·49	−45	32·46	−0·86	−3	35·74	−2·35	−7
	39. Hyderabad North	1·77	−1·19	−67	33·89	−3·08	−12	35·66	−5·17	−14
	40. Khandesh	1·07	−0·23	−21	29·94	−3·10	−10	31·01	−3·33	−11

No. 21. RAINFALL, 1902—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
		Inches.	Inches.		Inches	Inches		Inches.	Inches.	
Central Provinces and Berar.	41. Berar	1·50	−1·01	−67	30·46	−2·79	−9	31·96	−3·80	−12
	42. Central Provinces West.	1·73	−1·28	−74	42·32	−10·83	−26	44·05	−12·11	−27
	43. Central Provinces Central.	2·27	−1·39	−61	48·58	−12·96	−27	50·85	−14·35	−28
	44. Central Provinces East.	2·57	−0·89	−34	49·26	−11·58	−24	51·83	−12·4	−24
Bombay (North).	45. Gujarat	0·40	−0·20	−50	40·96	+0·28	+1	41·38	+0·08	0
	46. Kathiawar and Cutch.	0·44	−0·30	−68	27·03	−4·88	−18	27·47	−5·18	−19
	47. Sind	0·92	+0·08	+9	5·71	+2·47	+43	6·63	+2·55	+38
	48. Baluchistan Hills	4·78	−4·18	−87	3·65	−1·00	−27	8·43	−5·18	−61
Rajputana and Central India	49. Central India East	1·39	+0·01	+3	30·20	−2·49	−7	37·59	−2·45	−7
	50. Rajputana East, Central India West.	1·38	−0·87	−63	23·14	−0·81	−4	24·52	−1·68	−7
	51. West Rajputana	0·73	−0·54	−74	11·05	−2·62	−24	11·78	−3·16	−27
Madras	52 East Coast North	4·15	−0·88	−21	37·87	+1·72	+5	42·02	+0·84	+2
	53. Hyderabad South	2·40	−0·84	−35	27·39	−3·32	−12	29·79	−4·16	−14
	54. Madras Central	2·58	−0·07	−3	22·24	+0·91	+4	24·82	+0·86	+3
	55. East Coast Central	2·48	−1·66	−67	30·69	+17·26	+56	33·17	+15·60	+47
	56. Do. South	4·29	+1·42	+33	37·34	+7·77	+21	41·63	+9·11	+22
	57. Madras South	6·32	+4·29	+68	22·33	+11·07	+50	28·65	+15·36	+54

No. 22. NUMBER OF RAINY DAYS, 1902.

Province	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal
Burma	1. Tenasserim	26·2	+1·6	+6	117·8	−5·0	−4	144·0	−3·4	−2
	2. Lower Burma Deltaic.	17·8	−1·2	−7	105·3	−7·5	−7	124·1	−8·7	−7
	3. Central Burma	21·2	−0·9	−8	77·7	−2·8	−4	89·9	−3·7	−4
	4. Upper Do.	12·1	−0·1	−1	47·9	+0·9	+2	60·0	+0·8	+1
	5. Arakan	14·4	−0·8	−6	107·1	−8·8	−8	121·5	−9·6	−8
Bengal and Assam	6. Eastern Bengal	21·4	+7·7	+36	74·5	−0·6	−1	95·9	+7·1	+7
	7. Assam Surma	41·7	−1·4	−3	89·8	−2·6	−3	131·5	−4·0	−3
	8. Do. Hills	34·5	+3·8	+11	92·2	−2·0	−2	126·7	+1·8	+1
	9. Do. Brahmaputra.	38·1	+1·6	+4	71·3	+3·1	+4	109·4	+4·7	+4
	10. Deltaic Bengal	16·1	+5·6	+35	63·3	−3·5	−6	79·4	+2·1	+3
	11. Central Do.	12·4	+4·1	+33	59·0	−3·1	−5	71·4	+1·0	+1
	12. North Do.	20·8	+4·4	+21	67·6	+5·6	+8	88·4	+10·0	+11
	13. Bengal Hills	29·6	+3·8	+13	90·6	+6·6	+7	120·2	+10·4	+9
	14. Orissa	11·0	+2·4	+22	60·7	−6·0	−10	71·7	−3·6	−5
	15. Chota Nagpur	9·5	−0·3	−3	59·1	−8·2	−14	68·6	−8·5	−12
	16. South Bihar	6·5	−2·0	−31	47·5	−1·9	−4	54·0	−3·9	−7
	17. North Do.	8·7	+0·5	+6	49·9	−0·7	−1	58·6	−0·2	0

No. 22. NUMBER OF RAINY DAYS, 1902—*concluded.*

Province.	Division.	Dry Season, January to May.			Wet Season, June to December.			Whole Year.		
		Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.	Average normal.	Variation from normal.	Percentage variation from normal.
United Provinces of Agra and Oudh.	18. United Provinces East.	4·5	—1·7	—38	43·4	+0·2	0	47·9	—1·5	—3
	19. South Oudh	4·4	—2·4	—55	39·4	—1·2	—3	43·8	—3·6	—8
	20. North Do.	5·7	—1·6	—28	40·7	—1·4	—3	46·4	—3·0	—6
	21. United Provinces Central.	4·0	—1·9	—48	37·7	—4·2	—11	41·7	—6·1	—15
	22. United Provinces West.	5·2	—4·4	—85	28·7	+1·4	+5	33·9	—3·0	—9
	23. United Provinces East Submontane	5·6	—1·4	—25	43·7	—0·3	—1	49·3	—1·7	—3
	24. United Provinces West Submontane.	8·9	—4·3	—48	40·4	—2·8	—7	49·3	7·1	—14
	25. United Provinces Hills.	17·8	—5·7	—32	59·0	—5·2	—9	76·8	—10·9	—14
Punjab	26. South-East Punjab	5·4	—3·1	—57	23·1	—0·7	—3	28·5	—3·8	—13
	27. South Do.	5·3	—1·6	—30	16·7	—1·5	—9	22·0	—3·1	—14
	28. Central Do.	8·8	—3·4	—39	16·1	+1·1	+7	25·2	—2·3	—9
	29. Punjab Submontane.	9·8	—3·5	—36	24·6	—1·4	—6	34·4	—4·9	—14
	30. Punjab Hills	21·9	—2·1	—10	46·1	—1·3	—3	68·0	—3·4	—5
	31. North Punjab	14·7	—3·7	—25	19·6	+2·7	+14	34·3	—1·0	—3
	32. West Do.	5·5	—2·6	—47	9·3	+0·1	+1	14·8	—2·5	—17
Bombay and Malabar Coast Districts (Madras).	33. Malabar	14·0	—1·7	—12	104·0	+4·1	+4	118·0	+2·4	+2
	33-A. Travancore	..	...	...	...	...	...	...	...	...
	34. Madras South Central.	10·0	+3·7	+37	36·0	+6·1	+17	46·0	+9·8	+21
	35. Coorg	...	...	...	...	...	...	..	...	...
	36. Mysore	9·1	+1·4	+15	44·7	+3·3	+7	53·8	+4·7	+9
	37. Konkan	3·0	—1·7	—57	93·6	—4·9	—5	96·6	—6·6	—7
	38. Bombay Deccan	6·3	—2·9	—46	47·4	+1·6	+3	53·7	—1·3	—2
	39. Hyderabad North	4·2	—2·6	—62	48·2	—3·5	—7	52·4	—6·1	—12
	40. Khandesh	2·2	—0·5	—23	43·3	—2·3	—5	45·5	—2·8	—6
Central Provinces and Berar.	41. Berar	3·4	—2·1	—62	42·1	—0·9	—2	45·5	—3·0	—7
	42. Central Provinces West.	3·6	—2·1	—58	49·8	—4·8	—10	53·4	—6·9	—13
	43. Central Provinces Central.	4·8	—2·1	—44	54·3	—11·2	—21	59·1	—13·3	—23
	44. Central Provinces East.	5·6	—1·4	—25	54·8	—8·8	—16	60·4	—10·2	—17
Bombay (North).	45. Gujarat	0·8	—0·3	—38	44·8	—9·3	—21	45·6	—9·6	—21
	46. Kathiawar and Cutch.	0·9	—0·5	—56	30·0	—6·1	—20	30·9	—6·6	—21
	47. Sind	2·5	—1·5	—60	6·7	+1·3	+19	9·2	—0·2	—2
	48. Baluchistan Hills	11·7	—9·4	—80	7·5	—1·4	—19	19·2	—10·8	—56
Rajputana and Central India.	49. Central India East	3·2	—0·1	—3	42·9	—3·9	—9	46·1	—4·0	—9
	50. Rajputana East, Central India West.	3·5	—1·9	—54	29·5	—2·2	—7	35·0	—4·1	—12
	51. West Rajputana	1·9	—1·4	—74	14·2	—1·6	—11	16·1	—3·0	—19
Madras	52. East Coast North	6·8	—0·9	—13	49·4	+2·6	+5	56·2	+1·7	+3
	53. Hyderabad South	4·9	—0·6	—12	45·0	—4·9	—11	49·9	—5·5	—11
	54 Madras Central	4·7	+1·5	+32	34·7	+2·3	+7	39·4	+3·8	+10
	55. East Coast Central	3·5	—1·7	—49	37·4	+13·8	+37	40·9	+12·1	+30
	56. Do. South.	6·1	+1·0	+20	45·4	+10·6	+23	51·5	+12·2	+24
	57. Madras South	9·8	+3·2	+33	31·4	+11·5	+37	41·2	+14·7	+36

No. 23.

Province.	Division.	Ratio of Actual Rainfall to Number of Rainy Days in Wet Season, June to December.										
		1892.	1893	1894.	1895.	1896.	1897.	1898	1899.	1900.	1901.	1902.
Burma	1. Tenasserim	..	..	...	1·4	1·6	1·4	1·4	1·4	1·5	1·4	1·4
	2. Lower Burma Deltaic.	..	...	...	0·8	0·9	0·8	0·9	0·7	1·0	0·8	0·8
	3. Central Burma	..	...	...	0·6	0·6	0·6	0·6	0·5	0·7	0·6	0·7
	4. Upper Do.	...	...	...	0·7	0·7	0·7	0·7	0·7	0·8	0·7	0·8
	5. Arakan	...	...	...	1·2	1·7	1·4	1·6	1·4	1·6	1·5	1·6
Bengal and Assam.	6. Eastern Bengal	0·8	1·0	0·9	0·9	0·8	1·0	1·1	1·1	1·0	1·1	1·1
	7. Assam Surma	1·1	1·2	1·0	0·9	0·9	1·0	1·0	1·1	0·9	1·0	1·0
	8 Do. Hills	...	...	...	...	1·0	1·3	1·1	1·2	0·9	1·0	1·2
	9 Do. Brahmaputra	0·9	0·8	0·9	1·0	0·8	0·9	0·9	0·9	1·0	0·9	1·0
	10. Deltaic Bengal	0·7	0·8	0·7	0·7	0·7	0·8	0·8	0·9	0·8	0·8	0·8
	11. Central Do.	0·7	0·8	0·8	0·7	0·8	0·8	0·9	0·9	0·8	0·8	0·8
	12. North Do.	1·3	1·2	1·1	1·2	1·0	1·1	1·1	1·2	1·1	1·1	1·3
	13 Bengal Hills	..	...	...	...	1·1	1·1	1·2	1·1	1·1	1·0	1·3
	14 Orissa	0·8	0·8	0·8	1·0	0·9	0·8	0·9	0·9	1·1	0·8	0·9
	15. Chota Nagpur	0·8	0·8	0·8	0·8	0·9	0·8	0·9	0·8	0·9	0·8	0·8
	16. South Bihar	0·7	0·8	0·9	0·8	0·9	1·0	1·0	1·0	0·8	0·8	0·8
	17. North Do.	1·0	1·0	0·9	0·9	0·9	0·9	1·1	1·1	1·0	0·8	0·9
United Provinces of Agra and Oudh.	18. United Provinces East.	0·8	0·9	0·9	0·8	0·7	1·0	1·0	1·0	0·7	0·9	0·8
	19. South Oudh	0·9	1·0	1·1	0·9	0·9	0·9	1·0	1·0	0·8	1·0	0·8
	20 North Do.	0·9	1·0	1·1	0·9	0·9	1·0	1·0	0·9	0·9	0·9	0·9
	21. United Provinces Central.	0·8	0·9	1·0	0·9	0·7	0·9	0·9	1·0	0·7	1·0	0·8
	22. United Provinces West.	0·8	0·8	0·8	0·8	0·9	0·9	0·8	0·8	0·	0·7	0·8
	23. United Provinces East Submontane	0·9*	1·0*	1·1*	1·0*	0·8	1·0	1·1	1·1	0·9	0·8	0·9
	24. United Provinces West Submontane	...	...	...	...	1·0	1·1	1·0	0·9	0·9	1·1	1·0
	25. United Provinces Hills.	...	...	...	...	0·9	1·2	1·0	0·9	0·8	1·1	0·9
Punjab	26. South-East Punjab.	...	...	...	...	0·8	0·8	0·7	0·6	0·8	0·8	0·8
	27. South Punjab	0·8	0·9	0·9	0·6	0·5	0·7	0·7	0·6	1·0	0·7	0·7
	28. Central Punjab	0·8	0·8	0·8	0·7	0·7	0·7	0·8	0·6	0·8	0·8	0·7
	29. Punjab Submontane.	1·0	1·1	1·0	0·7	0·8	0·8	0·9	0·7	1·2	1·0	0·8
	30. Punjab Hills	1·0	0·9	1·1	0·9	0·9	0·9	0·9	0·8	1·0	1·0	0·7
	31. North-Punjab	1·0†	1·0†	0·8†	0·8†	0·6	0·7	0·8	0·6	0·7	0·7	0·6
	32 West Do.	0·9	0·7	0·7	0·7	0·6	0·7	0·7	0·6	0·5	0·6	0·6
Bombay and Malabar Coast Districts (Madras).	33. Malabar	1·0	1·0	1·0	1·1	1·3	1·5	1·0	1·1	1·3	1·2	1·3
	33A. Travancore	...	...	...	...	...	1·0	0·8	0·9	0·8	1·0	0·9
	34. Madras South Central.	0·7	0·7	0·6	0·7	0·6	0·7	0·7	0·6	0·6	0·7	0·7
	35. Coorg	...	...	...	0·8	1·7	1·2	0·7	0·8	1·1	0·9	1·0
	36. Mysore	...	0·6	0·6	0·6	0·7	0·7	0·7	0·6	0·8	0·6	0·7
	37. Konkan	1·3	1·1	1·1	1·1	1·4	1·3	1·2	0·8	1·3	1·2	1·2
	38. Bombay Deccan	0·7	0·7	0·7	0·7	0·8	0·7	0·7	0·6	0·8	0·6	0·6
	39. Hyderabad North.	...	...	...	0·8	0·7	0·7	0·6	0·6	0·7	0·7	0·7
	40. Khandesh	0·7	0·7	0·7	0·7	0·8	0·7	0·7	0·6	0·7	0·6	0·7
Central Provinces and Berar.	41. Berar	..	...	...	0·6	0·7	0·7	0·6	0·5	0·8	0·8	0·7
	42. Central Provinces West.	0·9	0·7	0·8	0·9	1·0	0·9	0·8	0·7	0·9	0·8	0·7
	43. Central Provinces Central.	0·8	0·9	0·8	0·8	1·0	0·8	0·9	0·8	0·9	1·0	0·8
	44. Central Provinces East.	1·0	0·9	0·9	1·0	1·2	0·9	0·8	0·8	1·0	0·8	0·8

* U. P. (Submontane). † North-West Punjab.

No. 23—*concluded.*

Province.	Division.	Ratio of Actual Rainfall to Number of Rainy Days in Wet Season, June to December									
		1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	902.
Bombay (North).	45. Gujarat	0·9	0·9	1·1	0·8	0·9	0·7	1·0	0·7	1·0	0 8	1·2
	46. Kathiawar and Cutch	0·8	0·9	1·1	0·7	1·0	0·8	0·9	0·7	1·1	0·7	0·9
	47. Sind	...	...	...	0·9	0·9	0·8	0·8	0·2	0·6	0·5	1·0
	48. Baluchistan Hills	...	...	...	...	0·5	0·6	0·5	0·3	0·5	0·5	0·4
Rajputana and Central India.	49. Central India	...	...	...	0·7	0·8	0·9	0·9	1·0	0·8	0·9	0·9
	50. Rajputana East, Central India West.	...	...	...	0·8	0·8	0·7	0.8	0·8	0·8	0·7	0·8
	51. West Rajputana	...	...	...	0·7	0·7	0·7	0 8	0·5	0·7	0 7	0·7
Madras.	52. East Coast North	0·8	0·8	0·7	0·8	0·7	0·7	0·8	0·7	0·7	0·7	0·8
	53. Hyderabad South.	...	...	...	0·7	0·6	0·6	0·6	0·5	0·6	0·6	0·6
	54. Madras Central	0·7	0·6	0 6	0·6	0·5	0·7	0·6	0·6	0·6	0·5	0·6
	55. East Coast Central.	0·8	1·0	0·8	0·7	0·8	0·7	0·9	0·9	0·6	0·8	0·9
	56. East Coast South.	0·7	0·9	0·7	0·9	0·8	0·7	0·9	0·9	0·7	0·8	0·8
	57. Madras South	0·6	0·7	0·6	0·8	0·7	0·6	0·7	0·7	0·7	0·7	0·8

No. 24. *Variation*

Station	1895.				1896.				1897.				18	
	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.	Cold weather.	Hot weather.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Baghdad	−1·34	−2·17	...	+0·24	+1·52	+1·38	−0·13	−2·27	−0·49	−1·43	−0·13	−0·36	−1·08	−0·80
Teheran	−0·20	−0.50	+1·60	−0·04	0	+0·45	−0·29	−0·17	+1·33	−0·30	−0·53	+0·43	−1·85	+1·55
Ispahan	−0·43	+2·13	+0·82	−0·85	+0·02	+0·84	−0·16	−0·91	+0·25	−0·90	−0·27	−0·57	+0·35	+0·07
Meshed	−1·33	+1.75	+0·13	−0·29	+0·78	+2·93	+0·40	−0·53	−0·05	+1·69	−0·13	−0·59	+0·24	−1·61
Bushire	−2·24	−0·91	+0·24	−4·49	−2·81	−0·25	+1·00	−4·29	+0·15	−1·16	−0·08	−4·11	−4·14	+3·16
Jask	+0·93	−0·28	+0·05	−1·23	−0·71	+1·02	−0·15	−0·84	−0·17	−1·06	−0·17	−1·16	−1·84	+1·45
Quetta	−2·72	−1·71	+0·28	+1·31	−0·71	−0·94	+0·56	−0·18	+0·04	+0·38	−1·69	+0·12	−2·73	+0·79
Chaman	−3·01	−0·18	0	−0·69	−0·53	−0·22	+0·33	+3·04	+1·52	+0·17	−0·27	−0·15	−2·45	+0·58
Kalat	−0·85	−0·39	−0·75	...	...	...	+2·71	−0·69	+0·76	0	−1·14	+0·0	−1·33	+1·81
Kabul	...	−0·16	+1·06	+0·49	−2·22	+4·51	−0·84	+0·01	+4·58	1·44	−0·13	−0·96	−1·89	−0·99
Gilgit	+0·07	−0·91	+0·16	+0·16	−0·09	−0·49	+0.21	−0·14	+0·31	−0·15	+0·53	−0·05	−0·17	+1·03
Kashgar	−0·33	−1·07	+0·44	−0·04	−0·39	−0·28	−1·14	−0·18	+0·19	−0·89	−0·65	−0·22	+0·01	−0·40
Port Blair	−1·42	−0·21	+11·07	−1·32	−0·60	+7·01	−0·77	−0·79	−1·36	−6·49	+13·07	+13·55	+3·54	+24·50
Singapore	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Penang	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Muscat	+2·75	+1·46	−0·42	−0·17	+0·55	+0·46	−0·25	+2·17	−0·29	−1·05	−0·42	−0·81	−1·87	+0·35
Aden	+0·69	−1·44	−0·14	−0·60	−0·01	−0·03	−0·31	−0·60	−0·54	−1·28	+0·30	−0·35	−0·46	−1·31
Perim	−0·35	−0·36	−0·52	−0·12	−0·34	+0·25	+2·02	−0·08	+0·02	−0·67	−0·54	−0·12	−0·49	+0·88
Amini Devi	...	...	+3·23	−1·81	−0·05	...	−8·19	+2·64	...	...	+8·46	−1·48	−0·19	−0·50
Minicoy	−1·06	−1·02	+3·82	−4·31	..	..	...	...	.	...	+4·22	−2·66	+2·08	−4·74

No. 25. *Percentage varia-*

Baghdad	−39	−78	...	+9	+43	+49	−100	−39	−14	−51	−100	−14	−30	−29
Teheran	−9	−12	+216	−40	0	+10	−39	−7	+63	−7	−72	+19	−88	+36
Ispahan	−100	+144	+304	−58	+5	+37	−59	−62	+58	−61	−100	−39	+81	+5
Meshed	−92	+35	+19	−24	+54	+59	+58	−44	−6	+34	−19	−49	+17	−33
Bushire	−41	−59	+300	−85	−51	−16	+1250	−85	+3	−76	−100	−82	−76	+207
Jask	+51	−24	+47	−97	−39	+56	−88	−66	−9	−90	−100	−91	−100	+97
Quetta	−64	−52	+14	+117	−17	−28	+28	−16	+1	+11	−84	+11	−64	+24
Chaman	−66	−10	0	−58	−30	−12	+122	+3	+50	+9	−100	−13	−81	+32
Kalat	−41	−30	−51	...	...	...	+184	−72	+37	0	−78	+6	−65	+138
Kabul	...	−2	+113	+49	−100	+60	−89	+1	+205	+19	−14	−95	−85	−13
Gilgit	+19	−39	+5	+114	−24	−21	+11	−100	+84	−8	+27	−35	−46	+45
Kashgar	−85	−89	+20	−18	−100	−23	−52	−82	+49	−74	−30	−100	+3	−33
Port Blair	−100	−1	+14	−8	−42	+34	−9	−61	−96	−31	+16	+86	+249	+120
Singapore	...	...	...	...	...	...	...	...	...	...	...	...	...	..
Penang	...	...	...	...	...	...	...	...	...	...	...	...	..	...
Muscat	+133	+135	−100	−20	+27	+43	−60	+249	−43	−97	−100	−100	−91	+32
Aden	+113	−100	−44	−100	−3	−65	−97	−100	−89	−89	+93	−58	−75	−92
Perim	−58	−55	−96	−100	−57	+38	+374	−67	+15	−100	−100	−100	−82	+133
Amini Devi	...	...	+8	−96	−26	...	−21	+139	...	...	+21	−78	−100	−7
Minicoy	−43	−35	+11	−49	...	...	...	...	...	...	+16	−30	+85	−43

of rainfall.

98.		1899.				1900.				1901.				1902.			
Rainy season.	Retreating monsoon period	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.	Cold weather.	Hot weather.	Rainy season	Retreating monsoon period.	Cold weather.	Hot weather.	Rainy season	Retreating monsoon period.
Ins.	Ins.	Ins.	Ins	Ins.	Ins.	Ins.	Ins	Ins.	Ins.	Ins	Ins.	Ins.	Ins	Ins	Ins.	Ins	Ins.
−0·13	−0·73	−3·15	−1·86	−0·03	−0·32	−1·90	−1·77	−0·05	+0·53	−3·02	−2·13	−0·11	−2·31	−2·98	+0·84	+0·35	−0·03
−0·74	−1·13	+0·23	−2·03	+0·14	+0·61	−0·57	−1·95	−0·39	+1·33	−1·70	−2·66	+0·11	−0·14	+0·78	−1·54	+0·52	+0·34
−0·27	−1·06	+0·14	−0·61	−0·04	+0·90	−0·01	−1·30	+0·44	−1·06	−0·43	+1·17	+0·16	−0·62	+0·38	+0·85	−0·24	+4·05
−0·34	−0·07	−0·03	−0·73	+0·81	+1·97	−0·36	−0·10	−0·11	+0·41	−1·41	−1·85	+2·26	+0·14	+1·75	−2·19	+0·89	+1·60
−0·05	−0·48	−2·56	−1·51	−0·03	+0·69	+2·00	−1·47	+0·97	+0·78	−4·23	−0·17	−0·05	−3·54	−4·39	−0·88	+0·30	+4·07
+0·60	−1·09	−1·36	−0·45	−0·17	+2·30	+1·40	−1·18	0	+2·45	−1·21	−1·18	−0·17	−1·27	−1·27	−1·18	+0·11	−0·60
−1·49	−0·85	−2·21	+0·69	−1·87	+0·04	+0·30	−0·03	−0·94	+4·70	−2·05	−0·74	−1·77	−1·12	−4·13	−0·11	−0·48	−0·05
−0·27	−1·01	+0·01	−0·39	−0·27	−0·39	+2·43	+0·30	−0·27	+3·63	−0·37	−0·33	−0·27	−1·17	−2·73	−1·47	+0·66	−0·07
−1·18	−0·52	−0·31	−0·95	−1·45	+0·44	−0·21	+0·57	−1·03	+5·05	+0·78	+1·05	+0·50	−0·96	−3·33	−0·73	−0·03	...
−0·84	−0·85	−2·22	−2·78	−0·27	+0·52	−2·23	−1·41	−0·53	+2·00	−2·22	+0·21	−0·84	−0·90	−1·61	−2·65	−0·49	−0·12
−0·36	+0·11	+0·13	−0·45	−0·57	−0·12	−3·10	−1·00	−1·06	+0·35	−0·04	−1·01	+1·10	−0·06	−0·33	+1·63	−0·31	+0·33
−0·25	−0·22	−0·33	−1·20	−0·27	+0·15	+0·17	−0·18	+0·13	−0·22	−0·27	...	−1·03	−0·22	−0·36	−0·05	−1·18	−0·22
−6·18	−12·68	−1·33	−1·28	−21·25	−6·75	−1·33	−5·18	−21·95	−5·19	+3·93	+1·23	+2·48	+7·48	+4·87	−2·78	+14·25	+4·62
...	...	..	.	...	..	.		...	..	.	...	...		...	..	..	...
..	...	...	...	...	...		.	.	..	.	..	.	..	..	.	...	..
+2·10	−0·22	−1·77	+0·48	−0·47	−0·35	+1·70	−0·43	−0·42	+2·54	−1·58	+0·01	−0·43	−0·35	−1·78	−0·81	+0·58	−0·35
−0·25	−0·3.	+0·73	−1·44	−0·30	−0·60	+0·62	−1·41	−0·32	−0·55	−0·29	−1·23	+1·03	−0·25	−0·15	−1·44	−0·32	−0·53
+0·09	+0·01	−0·25	+1·54	+0·63	−0·12	+1·63	+0·93	+1·36	+0·03	+0·02	−0·16	+0·43	+1·21	−0·43	−0·17	+0·81	−0·05
−1·51	+1·37	+0·31	+7·93	−16·20	−1·44	−0·19	−6·66	−0·46	+0·97	+0·45		−15·76	+2·11	+1·13	−4·69	+2·18	+6·45
−0·01	+11·61	−1·27	+3·62	+7·81	−2·74	−1·23	−5·36	+11·20	+7·62	+1·84	+5·11		+0·93	+1·84	−1·12	+21·07	+0·21

tion of rainfall.

−100	−29	−69	−66	−23	−13	−55	−03	−40	+21	−85	−76	−85	−90	−81	+30	+259	−1
−100	−48	+11	−08	+ 9	+26	−27	−47	−53	+57	−51	−62	+16	−6	+37	−35	+70	+15
−100	−73	+33	−41	−13	+69	−2	−83	+103	−73	−100	+79	+53	−43	+85	+57	−83	+278
−49	−6	−2	−15	+83	+164	−39	−2	−16	+34	−09	−37	+328	+12	+122	−44	+129	+132
−100	−10	−47	−59	−100	+14	+55	−95	+1213	+14	−78	−11	−100	−70	−80	−58	+375	+81
+353	−86	−74	−2	−100	+181	+76	−100	+ 0	+193	−67	−100	−100	−103	−64	−100	+63	−47
−74	−61	−52	+21	−93	+4	+9	−1	−47	+428	−48	−22	−88	−103	−9	−64	−24	−5
−100	−86	+1	−22	−100	−33	+83	+11	−100	+303	−19	−18	−100	−93	−90	−82	+244	−6
−80	−54	−15	−73	−90	+46	−12	+44	−70	+525	+38	+82	+34	−100	−93	−56	−3	...
−89	−85	−100	−36	−20	+58	−100	−18	−63	+298	−100	+3	−83	−89	−73	−35	−52	−12
−18	+79	+32	−19	−29	−86	−21	−43	−54	+107	−11	−44	+36	−43	−89	+71	−16	+164
−13	−100	−100	−100	−12	+59	+44	−15	+1	−100	−57	...	−50	−100	−92	−4	−34	−100
−8	−80	−94	−0	−27	−43	−98	−25	−23	−33	+278	+6	+3	+47	+343	−13	+18	+2
...	..	...	.	...	...	...		...	...	..	...	...	...		.	...	.
..	..	...	..	...	..	...	..	...		...	...	..	..	..	..	...	
+500	−25	−86	+44	−100	−98	+87	−40	−100	+202	−77	+3	−100	−40	−86	−75	+138	−40
−78	−63	+120	−100	−94	−100	+134	−98	−100	−93	−46	−89	+322	−42	−90	−100	−100	−88
+17	+8	−47	+238	+135	−104	+280	+141	+252	+17	+3	−17	+80	+1008	−75	−26	+150	−42
−4	+83	+5	+119	−41	−76	−100	−100	−1	+51	+237	...	−40	+111	+595	−70	+61	+339
−3	+155	−52	+33	+21	−30	−52	−53	+34	+86	+70	+48	..	+9	+76	−10	+66	+8

Appendix C.

No 26. *Smoothed vertical pressure anomalies, Leh—Lahore*

Month	1891	1892.	1893	1894	1895	1896.	1897	1898	1899.	1900	1901	1902	1903
January	— ·032	+ ·079	— ·061	— ·003	+ ·019	+ ·038	+ ·001	+ ·013	+ ·035	+ ·003	— ·030	+ ·063	0
February	— ·055	+ ·095	— ·080	— ·015	+ ·038	+ ·032	+ ·005	+ ·012	+ ·067	+ ·023	— ·007	+ ·065	— ·041
March	— ·062	+ ·137	— ·034	+ ·027	+ ·051	+ ·016	— ·004	+ ·027	+ ·056	+ ·013	+ ·005	+ ·020	— ·064
April	— ·046	+ ·146	+ ·008	+ ·038	+ ·046	+ ·039	?	+ ·025	+ ·042	— ·006	+ ·001	+ ·011	— ·087
May	— ·010	+ ·117	+ ·004	+ ·040	+ ·017	+ ·039	?	+ ·058	+ ·026	— ·014	+ ·006	0	— ·036
June	+ ·016	+ ·066	— ·037	+ ·023	+ ·005	+ ·032	?	+ ·025	+ ·041	+ ·024	+ ·033	+ ·005	— ·001
July	+ ·021	+ ·036	— ·050	— ·008	— ·031	— ·001	?	+ ·042	+ ·017	+ ·038	+ ·053	— ·006	+ ·021
August	+ ·028	+ ·033	— ·020	— ·015	— ·009	— ·010	?	+ ·071	+ ·027	+ ·018	+ ·035	+ ·004	+ ·025
September	+ ·002	+ ·024	— ·003	+ ·003	— ·001	— ·011	?	+ ·047	+ ·021	+ ·003	+ ·046	— ·008	+ ·033
October	+ ·042	+ ·012	+ ·003	0	+ ·018	+ ·010	?	+ ·045	+ ·017	+ ·011	+ ·048	— ·012	+ ·026
November	+ ·055	+ ·006	+ ·011	— ·011	+ ·024	+ ·006	?	+ ·030	+ ·014	+ ·004	+ ·052	— ·015	+ ·014
December	+ ·083	— ·024	— ·016	— ·027	+ ·048	— ·002	+ ·051	+ ·070	— ·006	— ·012	+ ·063	— ·007	— ·021
Year	+ ·004	+ ·061	— ·023	+ ·005	+ ·019	+ ·016	?	+ ·030	+ ·031	+ ·009	+ ·005	+ ·010	— ·011

NOTE.—From 1891 to 1897 the anomalies are derived from 10 and 16 hours data and for the remaining years from the 8 A.M. data.

No 27 *Smoothed 8 A.M. vertical pressure anomalies, Simla—Ludhiana*

January	— ·028	+ ·019	— ·057	— ·007	— ·016	+ ·007	— ·005	+ ·017	+ ·002	+ ·006	— ·035	+ ·027	— ·004
February	— ·070?	+ ·044	— ·065	— ·009	— ·010	+ ·017	+ ·004	+ ·025	+ ·015	+ ·018	— ·031	+ ·040	— ·011
March	— ·078?	+ ·071	— ·045	+ ·010	+ ·001	+ ·021	— ·001	+ ·034	+ ·029	+ ·018	— ·014	+ ·027	— ·002
April	— ·054?	+ ·074	— ·023	+ ·017	+ ·012	+ ·032	+ ·017	+ ·029	+ ·029	+ ·021	+ ·004	+ ·024	— ·024
May	— ·004	+ ·052	— ·015	+ ·027	+ ·008	+ ·030	+ ·017	+ ·035	+ ·017	+ ·023	+ ·021	+ ·008	— ·005
June	+ ·036	+ ·031	— ·023	+ ·013	+ ·017	+ ·030	+ ·030	+ ·017	+ ·027	+ ·042	+ ·033	+ ·011	+ ·022
July	+ ·032	+ ·015	— ·018	+ ·002	+ ·001	+ ·018	+ ·017	+ ·026	+ ·022	+ ·052?	+ ·039	+ ·009	+ ·032
August	+ ·028	+ ·015	— ·011	— ·004	+ ·013	+ ·018	+ ·013	+ ·017	+ ·027	+ ·040?	+ ·025	+ ·017	+ ·019
September	— ·003	— ·005	— ·010	+ ·008	+ ·005	+ ·011	+ ·013	+ ·018	+ ·023	+ ·028?	+ ·028	+ ·005	+ ·026
October	+ ·003	— ·013	— ·024	— ·003	+ ·009	+ ·007	+ ·016	+ ·011	+ ·022	+ ·025?	+ ·024	0	+ ·025
November	— ·005	— ·027	— ·023	— ·010	+ ·001	— ·005	+ ·012	+ ·009	+ ·019	+ ·010?	+ ·023	— ·005	+ ·015
December	+ ·012	— ·036	— ·030	— ·034	+ ·010	— ·008	+ ·018	— ·009	+ ·012	— ·012	+ ·024	— ·002	+ ·003
Year	— ·011?	+ ·020	— ·029	+ ·001	+ ·004	+ ·015	+ ·012	+ ·019	+ ·020	+ ·023?	+ ·012	+ ·013	+ ·007

No. 28. *Smoothed 8 A.M. vertical pressure anomalies, Quetta—Jacobabad.*

Month.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.
	"	"	"	"	"	"	"	"	"	"	"	"	"
January	−·039	+·063	−·035	+·003	+·008	+·012	−·007	+·043	+·026	+·018	−·021	+·058	+·022
February	−·033	+·025	−·035	−·006	+·018	+·031	−·010	+·019	+·034	+·026	+·009	+·063	+·011
March	−·021	+·032	0	+·015	+·034	+·019	−·009	+·047	+·041	+·023	+·025	+·046	−·009
April	−·014	+·037	+·017	+·027	+·032	+·033	+·011	+·036	+·037	+·013	+·036	+·040	−·024
May	+·016	+·043	+·019	+·025	+·027	+·039	+·018	+·049	+·031	+·011	+·037	+·034	−·014
June	+·025	+·017	+·003	+·011	+·016	+·029	+·025	+·026	+·030	+·024	+·039	+·019	+·011
July	+·042	+·003	+·009	−·001	−·001	+·013	+·013	+·035	+·029	+·033	+·039	+·013	+·029
August	+·042	+·030	+·010	−·004	−·005	+·001	+·003	+·035	+·035	+·034	+·010	+·029	+·036
September	+·026	+·020	+·014	+·001	−·009	−·013	+·012	+·031	+·006	+·010	+·023	+·016	+·048
October	+·043	+·024	+·006	0	−·007	−·004	+·027	+·029	+·003	+·011	+·021	+·010	+·040
November	+·019	+·012	+·014	−·011	−·006	−·002	+·023	+·025	+·015	−·006	+·029	+·011	+·042
December	+·060	0	+·008	−·013	+·012	−·006	+·030	+·018	+·012	−·010	+·044	+·014	+·027
Year	+·018	+·027	+·005	+·005	+·010	+·013	+·014	+·035	+·026	+·013	+·025	+·028	+·018

No. 29. *Smoothed variation of monthly mean pressure from normal at Mauritius.*

January	−·004	−·015	−·013	−·013	−·052	−·030	−·009	−·020	−·037	+·028	+·040	−·008	−·043
February	−·013	−·043	−·036	−·052	−·039	−·014	−·022	−·012	−·033	+·015	+·010	−·001	−·032
March	−·007	−·063	+·001	−·029	−·027	−·019	−·003	−·014	−·023	−·004	−·008	−·009	−·030
April	+·007	−·044	−·005	−·013	−·017	+·004	+·010	−·034	−·013	−·016	−·027	−·001	−·024
May	+·017	−·037	+·007	−·013	−·014	−·006	+·007	−·027	−·007	−·019	−·018	−·028	−·016
June	+·008	−·017	+·004	−·022	−·004	+·005	−·013	−·025	+·017	−·005	−·008	−·041	−·016
July	+·004	−·037	+·021	−·023	−·022	+·020	−·019	−·035	+·036	+·004	−·005	−·054	−·021
August	+·014	−·019	+·023	−·029	−·022	+·022	−·013	−·035	+·043	+·010	−·006	−·044	−·010
September	+·002	−·020	+·016	−·035	−·030	+·013	−·004	−·036	+·019	+·014	+·010	−·037	−·002
October	+·001	−·008	+·002	−·025	−·018	−·006	−·017	−·015	−·004	+·013	+·015	−·027	+·006
November	+·003	−·006	+·007	−·040	−·023	+·002	−·035	−·040	−·001	+·032	+·011	−·050	+·012
December	+·013	−·032	−·013	−·050	−·009	−·004	−·015	−·043	+·015	+·026	+·012	−·047	+·029
Year	+·004	−·029	+·001	−·031	−·024	−·001	−·011	−·032	+·001	+·009	+·003	−·029	−·012

No 30 *Smoothed variation of monthly mean pressure from normal at Zanzibar.*

Month	1891	1892	1893	1894.	1895	1896.	1897	1898	1899.	1900.	1901	1902	1903
	"	"	"	"	"	"	"	"	"	"	"	"	"
January	"	— 005	—·005	+ 008	—·004	—·003	+ 021	+·008	— 013	+ 012	+·021	+ 020	+·024
February		— 029	—·002	+ 011	— 001	+·010	+ 016	+ 007	—·001	+·036	+ 024	+ 030	+ 033
March		— 027	+ 012	+·003	—·002	+ 007	+ 042	— 006	—·006	+ 032	+ 009	+ 029	+ 017
April		—·010	+·005	+ 006	— 003	+ 002	+·040	— 028	+ 004	+ 026	0	+ 003	— 012
May	"	—·017	?	+·005	+ 011	—·004	+·039	— 028	+ 012	+ 022	+·007	— 0 0	—·026
June	+·009	— 021	?	—·003	+ 013	+ 007	+·008	— 034	+ 016	+ 007	+ 007	— 023	—·032
July	+·0 2	—·034	?	— 011	+ 002	+·011	+ 003	— 020	+ 026	+·008	+ 013	— 032	—·033
August	+·027	— 020	+ 006	— 024	— 003	+·014	— 007	—·026	+·037	+ 010	+·016	— 022	— 015
September	+ 018	—·010	+ 008	— 024	— 004	+ 013	+·007	—·015	+·022	+·0·1	+·030	— 005	— 005
October	+ 012	—·008	+ 001	—·020	+ 009	+·005	+·001	—·0·8	+·018	+ 010	+ 030	+·005	+·001
November	+ 010	— 007	+ 010	— 020	— 006	+·012	— 003	—·029	—·002	+ 004	+ 018	— 002	—·010
December	+ 019	— 022	+·014	— 011	—·006	+ ·013	—·005	—·019	+ 003	+ 008	+ 010	+ 002	—·011
Year	?	— 017	?	— 006	+ 001	+ 007	+ 014	— 018	+ 008	+ 016	+ 015	0	— 006

No 31 *Smoothed variation of monthly mean pressure from normal at Seychelles*

January	"	"			0	+ 004	— 004	— 016	—·020	0	+ 011	+ 0·2	—·001
February			"		— 002	+·008	—·006	—·018	— 006	+ 011	+ 018	+ 0 0	+·0 2
March	"	"	""		—·001	+ 004	+·002	— 020	— 006	+ 011	— 010	+·016	+ 039
April				+·002	— 004	+ 002	0	— 023	— 002	+ 012	— 020	— 007	—·011
May				+·003	—·003	0	— 008	— 023	+ 004	+ 013	—·014	— 008	—·028
June	"			—·009	—·003	+ 012	— 031	— 031	+ 008	+ 011	— 002	—·014	— 039
July	"	"	"	—·013	— 004	+·017	—·027	—·019	+ 020	+ 020	+ 006	—·0·0	— 040
August		"	"	—·020	+·003	+ 017	—·025	—·0·7	+·024	+·017	+ 007	—·0·4	—·030
September	"		"	—·011	—·005	+ 016	+ 001	— 013	+ 028	+ 026	+·020	—·016	— 018
October			"	—·004	+ 003	+·001	+·002	— 022	+·032	+·029	+·020	—·014	— 001
November			""	—·002	—·005	+ 006	+·004	—·019	+·016	—·001	+ 010	—·023	0
December				+·001	+·001	—·003	—·003	—·021	+·010	0	+ 006	—·020	+ 004
Year	"			?	—·002	+·007	— 008	—·022	+ 009	+·011	+·004	— 007	—·012

No. 32. *Actual variation of daily mean pressure at Batavia.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	"	"	"	"	"	"	"	"	"	"	"	"
1891	−·016	+·041	+·004	+·030	+·008	+·012	+·009	+·040	+·032	−·002	+·011	+·035
1892	−·003	−·035	−·066	−·005	+·021	−·023	−·003	−·017	−·008	−·029	−·022	+·014
1893	−·014	+·001	−·002	−·012	+·007	−·025	−·021	−·040	−·006	−·003	−·002	+·009
1894	−·037	+·023	−·015	+·003	+·012	−·002	+·005	−·010	−·008	−·013	+·023	+·008
1895	−·017	+·011	−·022	+·015	+·024	−·005	0	−·018	−·002	−·010	+·035	−·017
1896	+·005	+·016	−·019	−·015	+·042	−·005	+·013	+·035	+·019	+·044	0	+·028
1897	+·013	−·023	+·007	+·017	+·011	0	+·009	+·004	+·002	+·017	0	−·025
1898	+·003	−·058	−·036	−·003	−·012	−·008	−·026	+·008	−·009	−·014	−·038	−·012
1899	−·021	−·002	−·016	+·015	+·011	+·018	+·007	−·008	+·026	+·022	+·041	+·008
1900	+·016	+·010	+·023	+·020	+·036	+·002	−·017	−·015	+·009	+·011	·006	+·025
1901	+·011	+·021	+·013	−·012	+·010	−·001	−·021	+·007	+·026	+·015	+·002	+·017

No. 33. *Smoothed variation of daily mean pressure at Batavia.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	"	"	"	"	"	"	"	"	"	"	"	"
1891		+·010	+·025	+·014	+·017	+·010	+·020	+·027	+·023	+·014	+·015	+·014
1892	−·001	−·035	−·036	−·017	−·003	−·002	−·014	−·009	−·018	−·020	−·012	−·017
1893	−·010	−·015	−·004	−·002	−·010	−·013	−·029	−·022	−·016	−·003	+·002	−·010
1894	−·002	−·010	+·004	0	+·004	+·005	−·002	−·004	−·010	+·001	+·006	+·005
1895	+·001	−·009	+·011	+·006	+·011	+·006	−·008	−·007	−·010	+·008	+·003	+·008
1896	+·001	+·001	−·006	+·003	+·007	+·017	+·014	+·022	+·033	+·021	+·024	+·014
1897	+·006	−·001	0	+·012	+·009	+·007	+·004	+·005	+·008	+·006	−·003	−·007
1898		−·027	−·030	−·032	−·017	−·008	−·015	−·009	−·009	−·005	−·020	−·021	−·024
1899		−·012	−·013	−·001	+·003	+·015	+·012	+·006	+·008	+·013	+·030	+·024	+·022
1900		+·011	+·016	+·018	+·026	+·019	+·007	−·010	−·008	+·002	+·005	+·010	+·010
1901		+·019	+·015	+·007	+·004	−·001	−·004	−·005	+·004	+·016	+·014	+·011	

No. 34. *Actual variation of daily mean pressure at Hong-Kong*

Year.	January	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	"	"	"	"	"	"	"	"	"	"	"	"
1891	−·015	+·035	+·008	+·026	−·018	−·041	−·056	−·007	−·024	−·014	−·007	+·041
1892	+·039	−·099	−·040	+·002	+·004	−·002	+·011	+·066	−·063	+·020	−·043	+·043
1893	−·043	+·024	+·009	−·006	−·008	+·009	+·037	+·022	−·063	−·011	+·074	+·007
1894	−·044	+·047	+·003	−·013	−·025	+·006	+·038	−·003	−·033	−·002	+·009	−·001
1895	+·008	−·037	+·008	−·012	−·008	+·025	+·012	−·014	−·007	+·007	+·038	−·005
1896	−·006	+·020	+·014	−·025	+·022	+·031	−·045	+·022	+·014	−·024	−·046	+·048
1897	−·059	+·027	−·022	+·035	−·012	−·050	+·045	+·015	+·045	−·006	−·046	+·021
1898	+·038	−·133	−·045	+·022	−·020	−·078	+·034	−·095	+·042	−·071	−·073	−·019
1899	+·026	−·028	+·030	+·005	−·006	+·038	−·083	−·046	+·067	+·073	+·006	−·078
1900	+·018	+·036	+·011	−·004	+·016	+·010	+·061	−·051	+·023	+·039	−·053	−·002
1901	−·038	+·117	+·083	−·029	+·007	−·017	+·021	−·058	+·054	−·038	+·023	−·019
1902	−·013	+·167	−·025	+·033	−·031	−·034	−·023	−·015	+·052	+·141	+·010	−·071

No. 35. *Smoothed variation of daily mean pressure at Hong-Kong.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September	October	November.	December.
	"	"	"	"	"	"	"	"	"	"	"	"
1891	...	+·009	+·023	+·005	−·011	−·038	−·035	−·029	−·015	−·015	+·007	+·024
1892	−·006	−·033	−·046	−·011	+·001	+·004	+·025	+·005	+·008	−·029	+·007	−·014
1893	+·008	−·003	+·009	−·002	+·028	+·043	+·053	−·001	− 017	0	+·023	+·012
1894	+·003	+·002	+·012	−·012	−·011	+·006	+·014	+·001	− 013	−·009	+·002	+·005
1895	−·010	−·007	−·014	−·004	+·002	+ 010	+·008	−·003	−·005	+·013	+·013	+ 009
1896	+·003	+·009	+·003	+·004	+·009	+·003	+·003	−·003	+·004	−·019	−·007	−·019
1897	+·005	−·018	+·013	0	−·009	−·006	+·003	+·035	+·018	−·002	−·016	+·004
1898	−·025	−·047	−·052	−·014	−·027	−·021	−·046	−·006	−·041	−·034	−·054	−·022
1899	−·007	+·009	+·002	+·010	+·012	−·017	−·030	−·021	+·031	+·049	0	−·018
1900	−·008	+·022	+·014	+·008	+·007	+·029	+·007	+·011	+·004	+·003	−·005	−·031
1901	+ 026	+ 054	+·057	+·020	−·013	+·004	−·018	+·006	− 014	+·013	−·011	−·003
1902	+·045	+·043	+·058	−·008	−·011	−·029	−·024	+·005	+·046	+·054	+ 013	..

No. 36. *Actual pressure variation from normal (mean day) at Perth.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December
	"	"	"	"	"	"	"	"	"	"	"	"
1891	−·010	+·026	+·008	+·022	−·058	+·016	+·118	+·107	+·049	+·016	+·043	+·022
1892	− 003	+·019	−·099	+·052	+·018	+·104	−·047	−·102	−·002	+ 025	− 016	− 010
1893	−·048	−·079	+ 031	−·136	−·091	+·031	−·102	+·087	−·093	−·073	0	−·046
1894	−·008	+·039	−·020	+·020	+·042	+·024	+·052	−·013	−·004	+ 012	−·016	−·043
1895	−·011	+·026	+·074	+·047	+ 088	−·002	−·002	−·073	−·002	+·022	+·031	+·011
1896	−·066	−·002	− 072	+·028	+·053	−·032	−·038	+·056	+·079	+·042	−·038	+·049
1897	+·004	+·025	−·004	− 001	+ 038	−·054	+·036	+·070	+·001	+ 024	− 008	−·009
1898	−·015	−·097	−·058	+·091	+·002	− 011	−·020	−·090	−·013	−·083	−·003	− 014
1899	+·014	−·010	−·062	−·068	+·055	−·044	−·013	+·087	+ 054	− 078	+ 035	+·036
1900	+·038	+·025	+·064	−·055	+·056	−·135	−·046	−·062	+·072	−·009	−·032	+·056
1901	+·026	−·028	−·002	−·030	−·003	+·017	+·073	+·003	+·038	+·047	+·025	−·012

No. 37. *Smoothed pressure variation from normal (mean day) at Perth.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November.	December.
	"	"	"	"	"	"	"	"	"	"	"	"
1891	..	+·008	+ 019	−·009	− 007	+ 025	+·080	+·091	+·057	+·036	+·027	+·021
1892	+·013	+·028	−·009	−·010	+ 058	+·025	− 015	− 050	−·026	+·002	0	− 025
1893	−·046	−·032	−·061	−·065	− 065	−·054	+·005	−·036	−·026	− 055	−·040	− 018
1894	−·005	+·004	+·013	+·014	+·029	+·039	+·021	+·012	−·002	−·003	− 016	−·025
1895	−·009	+·030	+ 049	+·070	+·044	+·028	− 026	−·026	−·018	+·017	+·021	−·008
1896	−·019	−·047	−·015	+·003	+·016	− 026	−·005	+ 032	+·059	+·028	+·018	+·005
1897	+·026	+·008	+·007	+·011	−·006	+·007	+·017	+·036	+·032	+·006	+·002	− 011
1898	−·040	−·057	− 021	+·012	+·027	−·010	−·040	−·041	−·062	− 033	−·033	− 001
1899	−·003	−·019	−·047	− 025	−·019	−·001	+·010	+·013	+·021	+ 004	− 002	+ 036
1900	+·033	+·042	+·011	+·022	−·051	−·048	−·088	−·012	0	+ 010	+·005	+·017
1901	+·018	−·001	−·020	−·012	−·005	+·029	+·031	+·038	+·029	+·037	+·020	...

Meteorological Provinces.	1891.				1892.				1893.				1894.			
	Cold weather, January and February.	Hot weather, March to May.	Rainy season, June to October	Retreating monsoon period, November and December	Cold weather, January and February.	Hot weather, March to May.	Rainy season, June to October.	Retreating monsoon period, November and October	Cold weather, January and February.	Hot weather, March to May	Rainy season, June to October.	Retreating monsoon period, November and December.	Cold weather, January and February.	Hot weather, March to May.	Rainy season, June to October.	Retreating monsoon period, November and December.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Burma Coast and Bay Islands.	—·021	—·013	—·013	—·006	—·032	+·007	+·005	—·007	—·014	—·014	—·003	+·015	—·016	—·003	+·006	+·014
Assam . . .	—·014	—·019	—·017	—·035	—·015	—·010	+·021	—·015	+·004	0	+·009	+·033	—·010	—·020	+·004	+·004
Bengal and Orissa	—·001	0	—·010	—·007	—·004	—·002	+·016	+·031	+·003	—·001	+·006	+·013	—·004	—·013	+·034	+·003
Gangetic Plain and Chota Nagpur.	+·003	+·001	—·003	+·002	—·003	—·017	+·003	—·018	+·006	+·009	+·001	+·001	—·004	—·013	0	—·024
North-West India .	+·011	+·016	+·002	+·021	+·001	—·014	0	—·311	+·003	+·006	0	—·005	+·009	0	—·001	—·007
Deccan . .	+ 0·6	—·001	+·008	+·010	+·009	+·013	—·002	+·003	—·004	+·023	0	—·002	0	+·011	—·002	—·004
West Coast . .	—·005	—·018	+·013	—·034	—·006	+·013	—·018	+·016	0	—·008	—·007	—·015	—·005	+·016	+·001	+·003
South India . .	—·008	—·016	+·008	—·004	+·007	+·007	—·009	+·019	—·009	—·011	—·005	—·009	—·004	+·003	—·003	+·005

Meteorological Provinces.	1895.				1896.				1897.				1898.			
	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Burma Coast and Bay Islands.	—·018	—·008	—·013	+·002	+·001	—·001	—·013	+·015	—·003	—·013	+·007	—·007	—·011	—·017	—·003	+·012
Assam . . .	—·001	—·004	+·004	—·003	—·004	—·013	—·013	+·014	—·009	+·002	+·004	—·002	—·002	—·006	0	—·009
Bengal and Orissa .	+·004	—·002	+·002	—·006	—·013	—·015	—·016	+·010	—·007	0	+·003	—·006	—·004	—·002	—·003	+·007
Gangetic Plain and Chota Nagpur.	+·011	+·001	+·005	—·006	—·009	—·014	—·007	—·001	—·001	—·007	—·005	—·009	—·005	—·005	—·005	—·010
North-West India .	+·002	—·005	+·004	—·005	—·006	+·004	+·003	—·004	+·007	+·001	+·001	+·001	—·011	+·003	—·003	—·007
Deccan . . .	+·001	+·004	+·003	+·011	+·013	+·004	+·010	—·007	—·006	+·004	+·002	+·011	+·017	+·008	+·008	+·004
West Coast . .	—·005	+·003	—·012	+·006	+·015	+·017	+·009	—·010	+·011	+·005	—·007	+·006	+·007	+·002	0	—·001
South India . .	—·002	+·005	—·007	+·007	+·010	+·005	+·011	+·001	—·004	—·003	—·004	—·001	+·009	0	+·003	+·006

Meteorological Province.	1899.				1900.				1901.				1902.			
	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.	Cold weather.	Hot weather.	Rainy season.	Retreating monsoon period.
	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
Burma Coast and Bay Islands.	+·002	−·012	−·009	+·013	+·001	−·011	−·014	+·007	−·014	−·019	−·007	+·005	+·003	+·007	+·001	−·009
Assam	−·002	−·006	−·014	+·002	0	−·001	+·005	−·001	−·003	−·001	−·007	+·006	+·007	+·015	0	+·004
Bengal and Orissa	−·004	−·008	−·006	+·004	−·003	0	0	+·005	+·008	+·002	−·012	−·001	0	+·008	+·001	+·006
Gangetic Plain and Chota Nagpur.	−·008	−·003	−·008	−·016	−·008	0	+·002	−·003	+·014	+·004	−·013	−·004	0	−·006	0	+·004
North-West India	+·001	−·003	−·004	−·002	−·001	+·003	+·004	−·009	+·010	+·002	−·003	−·003	−·003	−·012	−·002	+·001
Deccan	+·003	+·010	+·016	+·004	−·008	+·002	−·001	+·002	−·006	+·003	+·011	+·006	−·002	−·003	+·004	+·002
West Coast	+·004	+·010	+·011	+·026	+·007	+·006	+·002	−·005	−·010	−·012	+·011	−·002	−·010	+·006	−·010	−·014
South India	−·001	+·006	+·002	+·028	+·002	−·002	−·002	+·013	−·014	0	+·008	−·003	−·001	+·005	0	−·005

Appendix D.

No 39.

Area.	Actual date of commencement of monsoon rains in										
	1892	1893.	1894.	1895	1896.	1897	1898	1899.	1900	1901	1902.
Lower Burma	May, 22	June, 12	June, 4	June, 12	June, 12	June, 6	June, 4	May, 25	June, 6	June, 7	June, 8
Upper Burma	June, 4	„ 13	„ 8	„ 14	„ 15	„ 7	„ 4	„ 25	„ 7	„ 8	„ 7
Assam	„ 9	„ 17	„ 13	„ 15	„ 17	„ 12	„ 9	June, 6	„ 12	„ 11	„ 13
Bengal	„ 10	„ 14	„ 14	„ 13	„ 18	„ 13	„ 16	„ 13	„ 11	„ 13	„ 13
Bihar	„ 6	„ 14	„ 14	„ 16	„ 19	„ 17	„ 18	„ 14	„ 14	July, 6	„ 16
Chota Nagpur	„ 7	„ 14	„ 14	„ 19	„ 19	„ 17	„ 16	„ 14	„ 14	„ 6	July, 4
United Provinces, East.	„ 6	„ 18	„ 16	„ 14	„ 16	„ 18	„ 11	„ 17	July, 12	„ 9	„4 or 5
United Provinces, West.	„ 6	„ 25	„ 17	„ 14	„ 25	„ 14	„ 14	„ 19	„ 11	„ 10	June, 29
East Punjab	„ 7	„ 23	„ 17	„ 14	„ 25	„ 15	„ 15	„ 21	„ 10	„ 9	„ 20
North Madras	„ 2	„ 14	„ 10	„ 8	„ 13	„ 15	„ 6	„ 12	June, 10	June, 15	July, 2
Malabar	May, 26	„ 4	„ 6	„ 12	„ 13	„ 12	„ 9	„ 5	„ 12	„ 6	June, 8
Konkan	„ 29	„ 7	„ 8	„ 12	„ 15	„ 13	„ 10	„ 11	„ 25	„ 11	„ 10
Central Provinces	June, 4	„ 17	„ 7	„ 14	„ 17	„ 14	„ 14	„ 12	„ 25	„ 25	July, 2
Central India	„ 6	„ 25	„ 10	„ 12	„ 21	„ 14	„ 10	„ 13	July, 10	July, 5	„ 4
Gujarat and Kathiawar	„ 4	„ 13	„ 11	„ 13	„ 14	„ 16	„ 10	„ 16	„ 12	„ 7	„ 5
Rajputana	„ 7	„ 23	„ 10	„ 12	„ 21	„ 15	„ 11	„ 20	„ 10	„ 8	June, 29

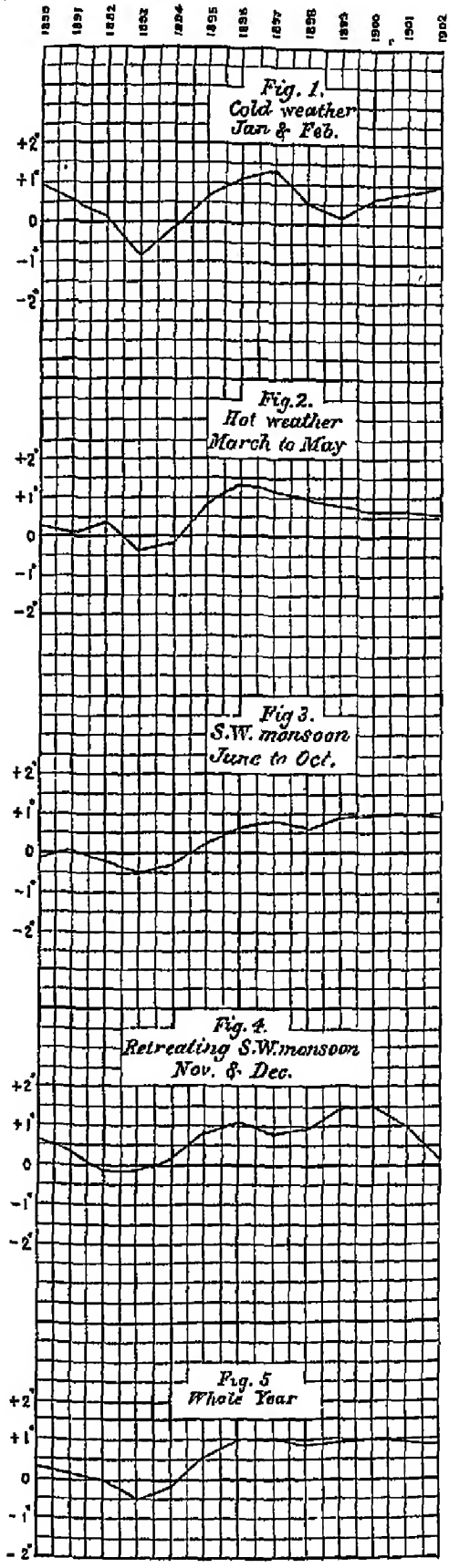
No. 40.

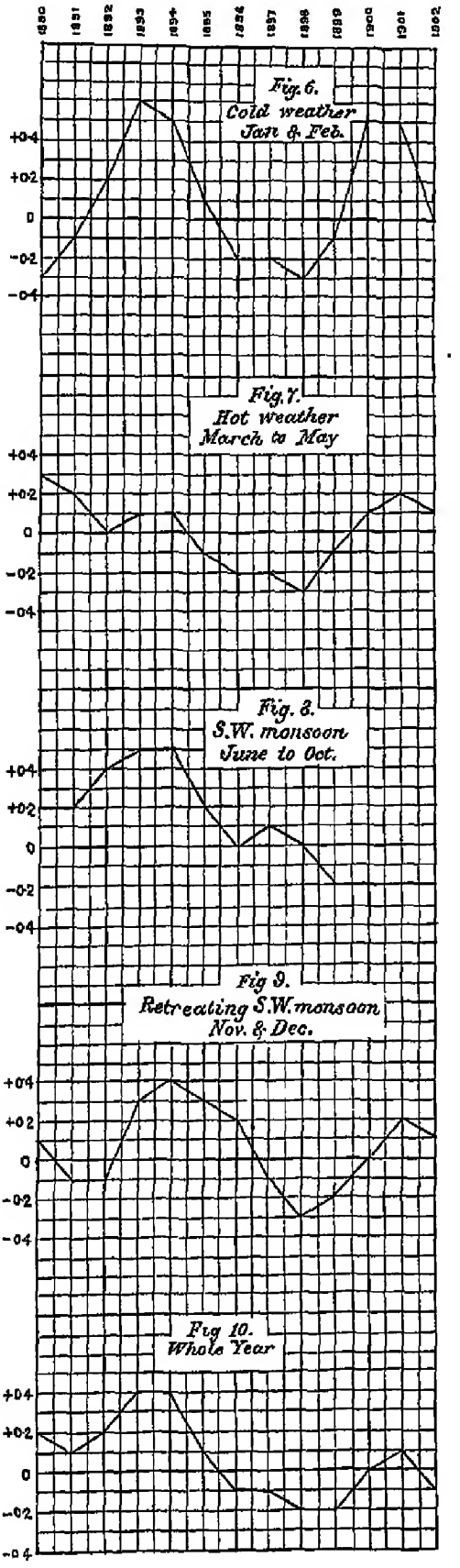
Area.	Actual date of termination of monsoon rains in										
	1892	1893.	1894	1895.	1896.	1897	1898	1899.	1900.	1901.	1902
Lower Burma	Nov., 9	Oct., 30	Oct., 14	Oct., 27	Oct., 28	Nov., 16	Oct., 22	Nov., 9	Oct, 17	Oct, 24	Oct, 21
Upper Burma	„ 4	„ 29	„ 14	„ 29	„ 18	Oct, 26	„ 17	„ 8	„ 15	„ 14	„ 10
Assam	„ 2	„ 24	„ 27	„ 28	Sept., 24	„ 26	„ 17	Oct., 30	„ 13	„ 11	„ 8
Bengal	„ 2 or 3	„ 23	Nov., 6	„ 29	„ 21	„ 25	„ 16	Sept., 25	„ 13	„ 9	„ 10
Bihar	Oct., 30 (South Bihar)	„ 20	„ 6	„ 29	„ 18	„ 20	„ 15	„ 25	„ 12	Sept., 27	„ 7
Chota Nagpur	Nov, 1	„ 20	„ 6	„ 28	„ 17	„ 20	„ 15	„ 24	„ 10	„ 26	Sept, 26
United Provinces, East.	Sept., 27	„ 19	„ 5	Sept., 21	Aug, 30	„ 20	Sept., 17	„ 16	„ 10	„ 25	„ 26
United Provinces, West.	„ 26	„ 19	„ 5	„ 10	„ 28	Sept., 26	„ 14	„ 15	Sept., 28	„ 7	„ 22
East Punjab	„ 25	Sept., 20	Sept., 12	„ 4	„ 22	„ 26	„ 16	„ 14	„ 28	„ 5	„ 22
North Madras	Nov, 2	Nov, 14	Nov., 8	Nov, 1	*	Nov., 12 or 13	Nov., 10	Nov., 2	Nov., 7	Nov, 25	Dec, 16
Malabar	„ 4	„ 24	„ 18	„ 4	Oct., 22	„ 4	„ 16	Oct., 31	Oct, 29	Oct, 28	Nov, 8
Konkan	„ 2	Oct., 17	Oct., 28	„ 4	Sept., 2	Oct., 14	Oct., 27	Sept, 25	Sept, 27	Sept., 13	Sept., 22
Central Provinces.	Sept., 27	„ 18	Nov, 6	Sept., 24	Aug, 31	Sept, 25	Sept, 30	„ 15	„ 28	„ 25	„ 22
Central India	„ 28	„ 18	„ 6	„ 23	„ 28	„ 27	„ 17	„ 14 or 15	„ 28	„ 25	„ 23
Gujarat and Kathiawar.	„ 25	„ 3	Oct., 27	Oct, 25	„ 18	Oct, 9	„ 16	July, 31	„ 29	„ 13	„ 27
Rajputana	„ 25	Sept., 19	Sept., 13	Sept, 17	„ 18	Sept, 26	„ 16	„ 22	„ 27	„ 3	„ 22

*No rain, except showers between the 22nd and 25th November.

SMOOTHED MEAN VARIATION OF TEMPERATURE OF WHOLE INDIA 1890–1902.

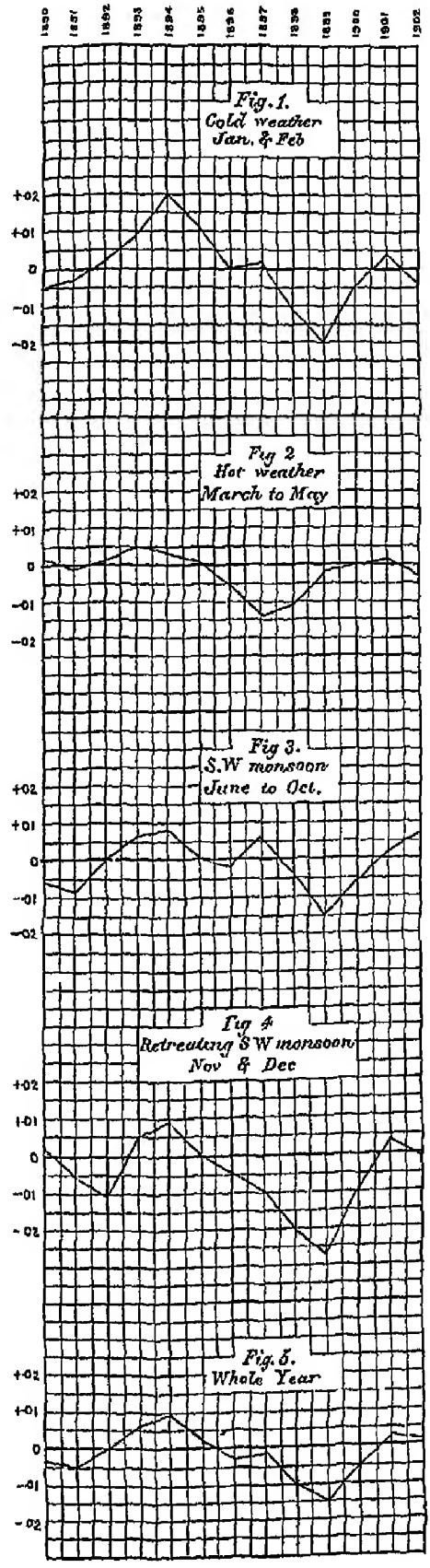
SMOOTHED MEAN VARIATION OF CLOUD AMOUNT OF WHOLE INDIA 1890–1902.

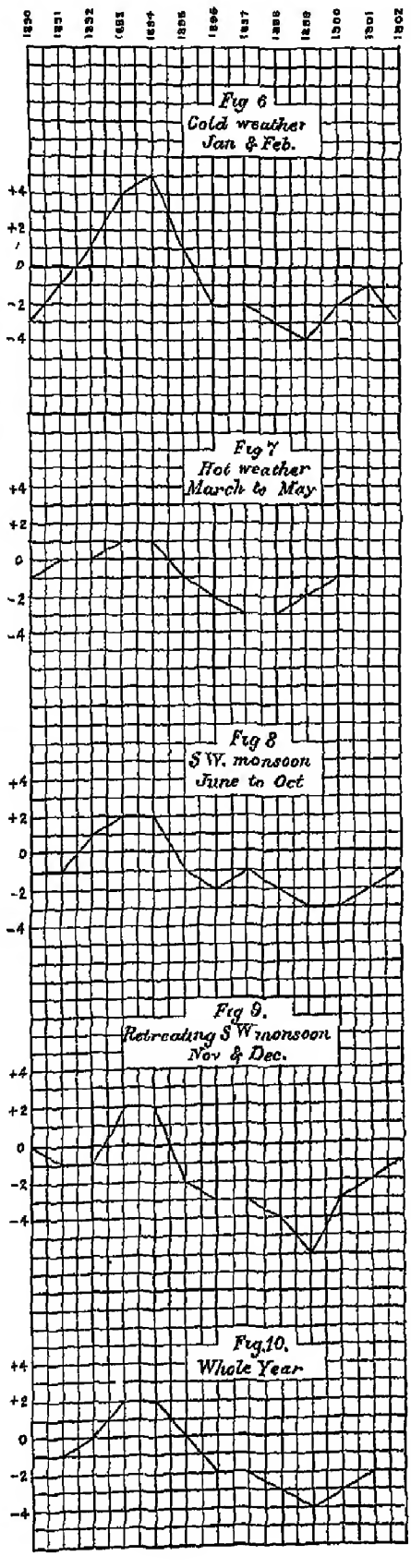




SMOOTHED MEAN VARIATION OF ABSOLUTE HUMIDITY (AQUEOUS VAPOUR PRESSURE) FROM NORMAL, 1890 - 1902

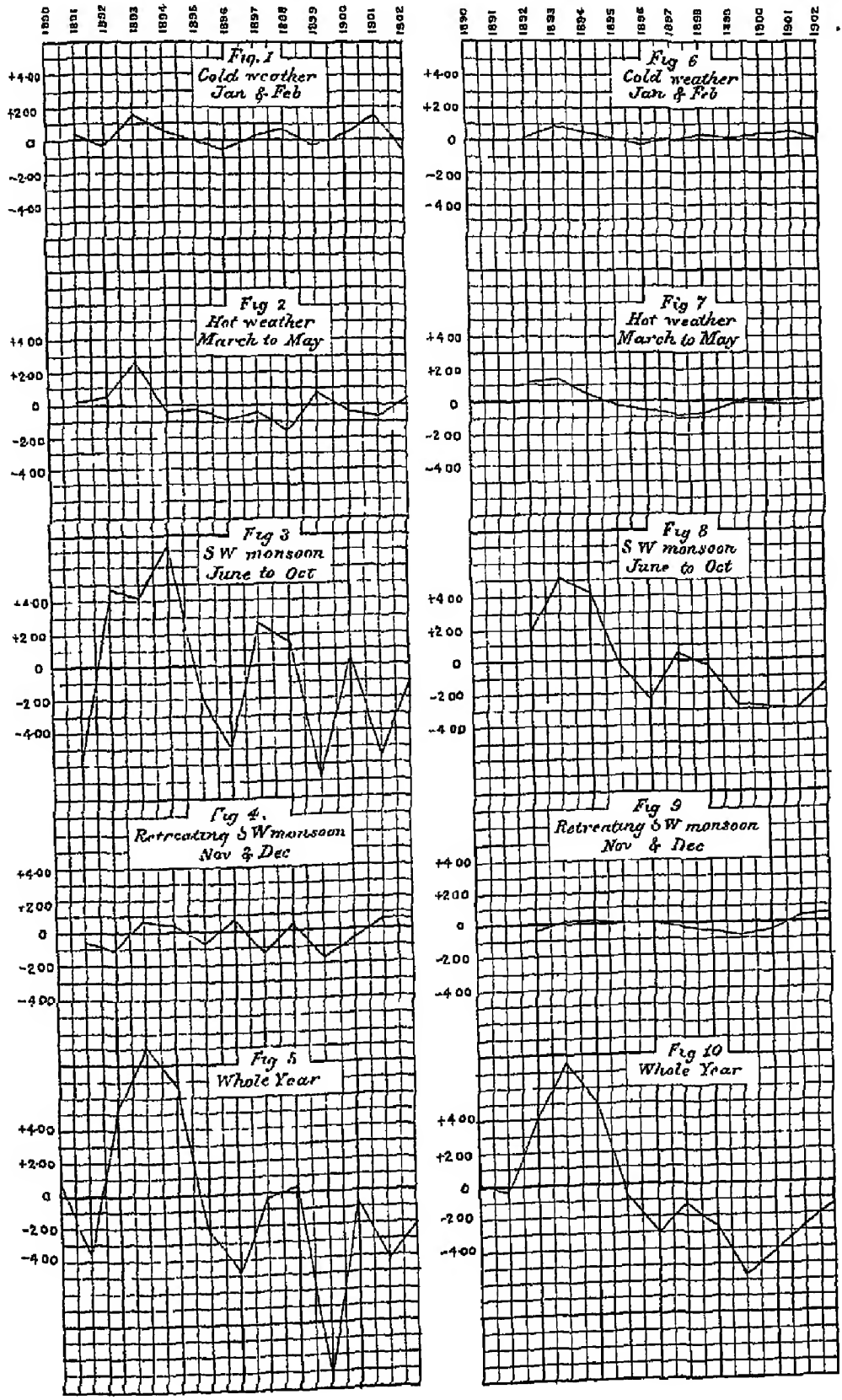
SMOOTHED MEAN VARIATION OF RELATIVE HUMIDITY FROM NORMAL, 1890 - 1902.



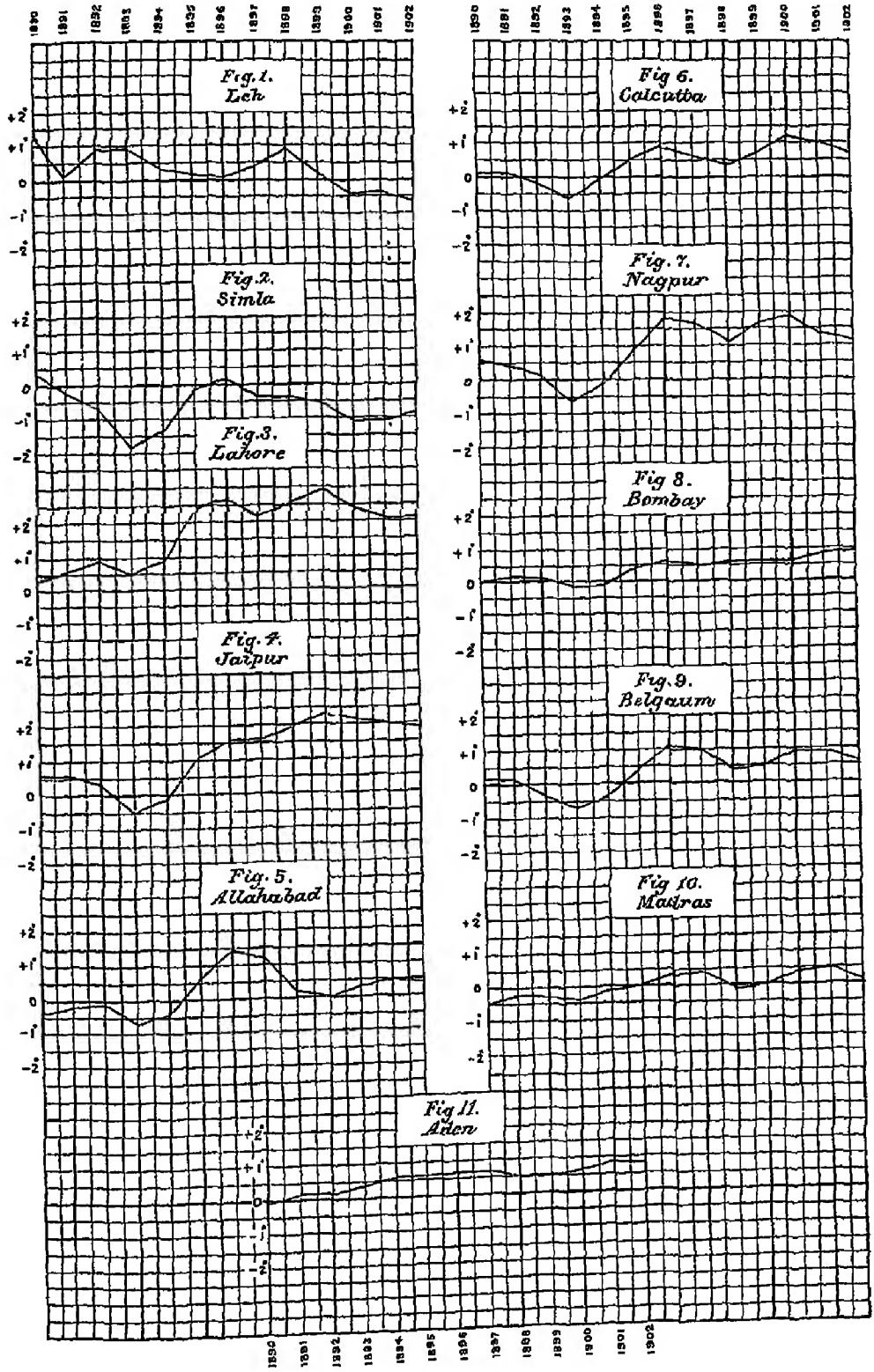


ACTUAL MEAN VARIATION OF RAINFALL OF INDIA, 1890-1902

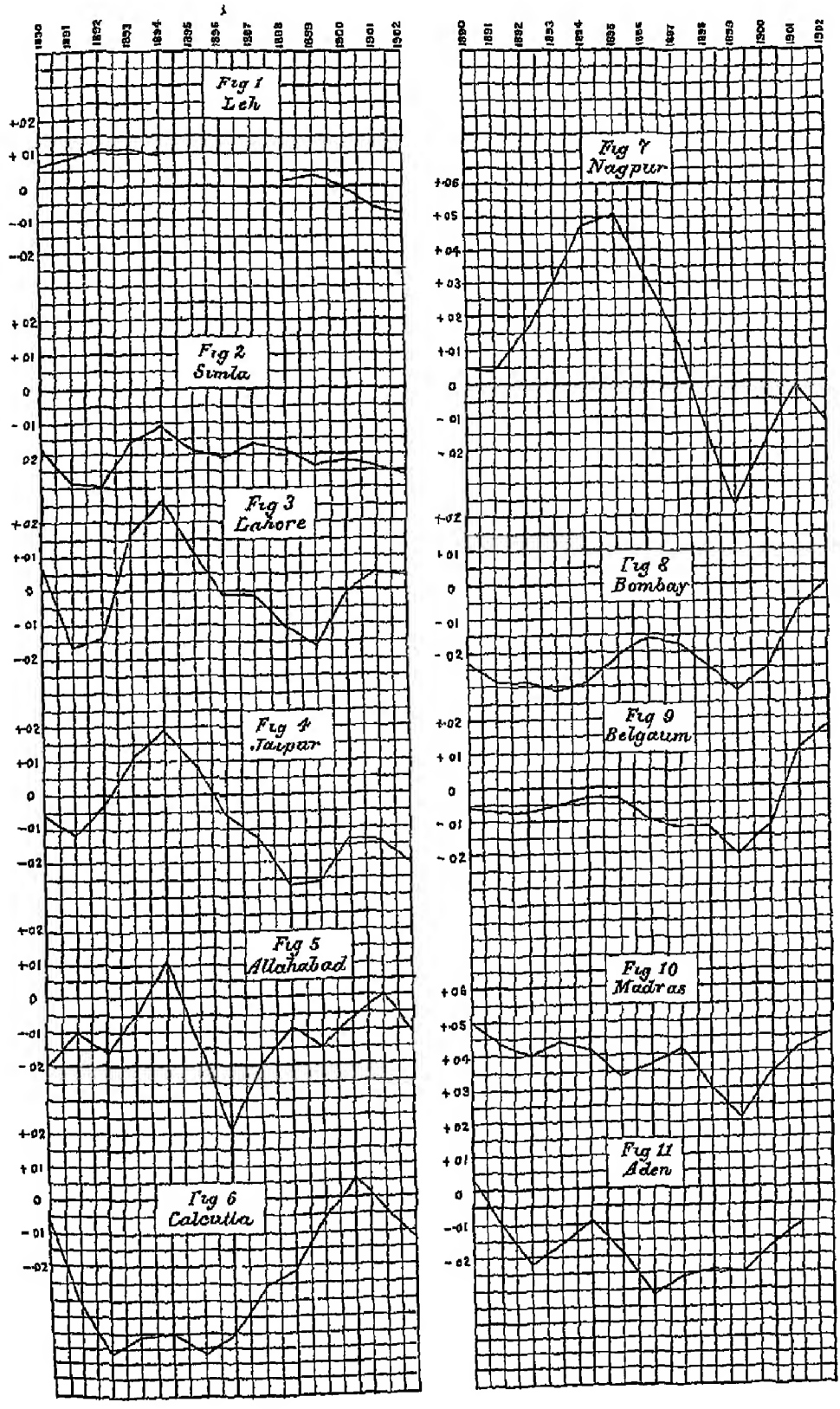
SMOOTHED MEAN VARIATION OF RAINFALL OF INDIA, 1880-1902



SMOOTHED VARIATION FROM NORMAL OF MEAN ANNUAL TEMPERATURE AT ELEVEN SELECTED AND REPRESENTATIVE STATIONS DURING THE PERIOD, 1890–1902.

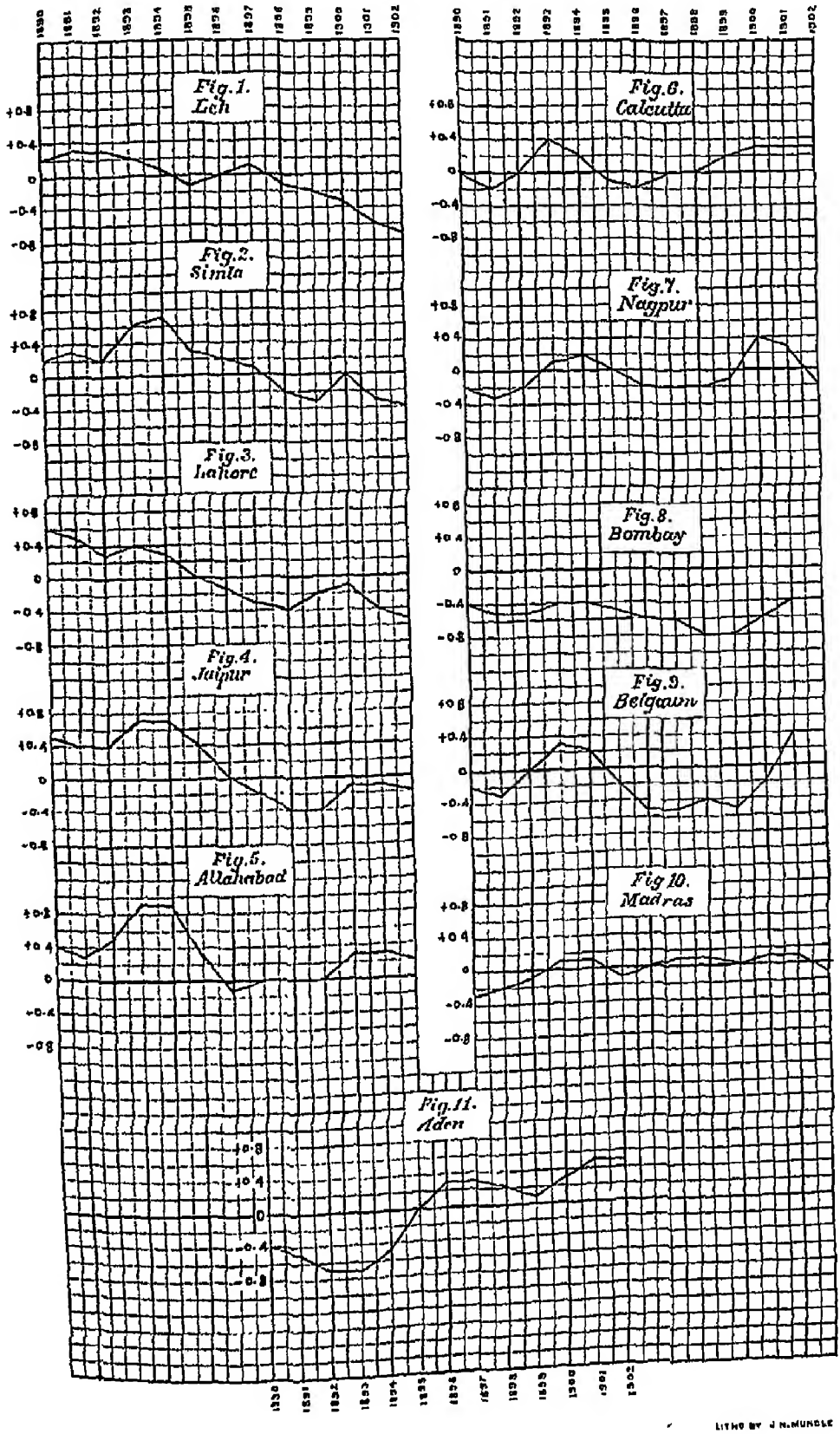


SMOOTHED VARIATION FROM NORMAL OF MEAN ANNUAL VAPOUR PRESSURE OR ABSOLUTE HUMIDITY AT ELEVEN SELECTED AND REPRESENTATIVE STATIONS DURING THE PERIOD, 1890 - 1902



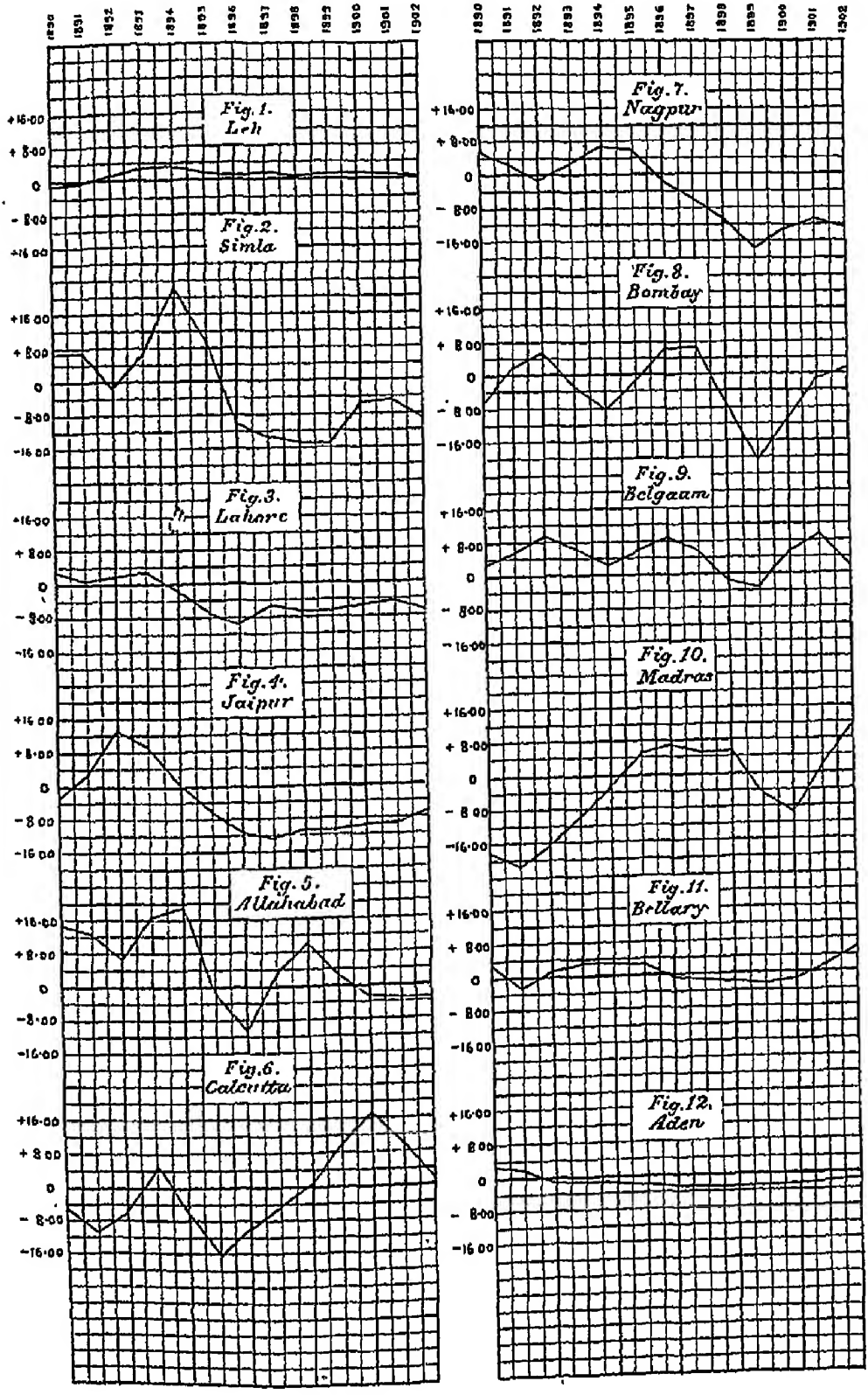
LITHO BY J N MUKHLE

SMOOTHED VARIATION FROM NORMAL OF MEAN ANNUAL CLOUD AMOUNT AT ELEVEN SELECTED AND REPRESENTATIVE STATIONS DURING THE PERIOD, 1890–1902.



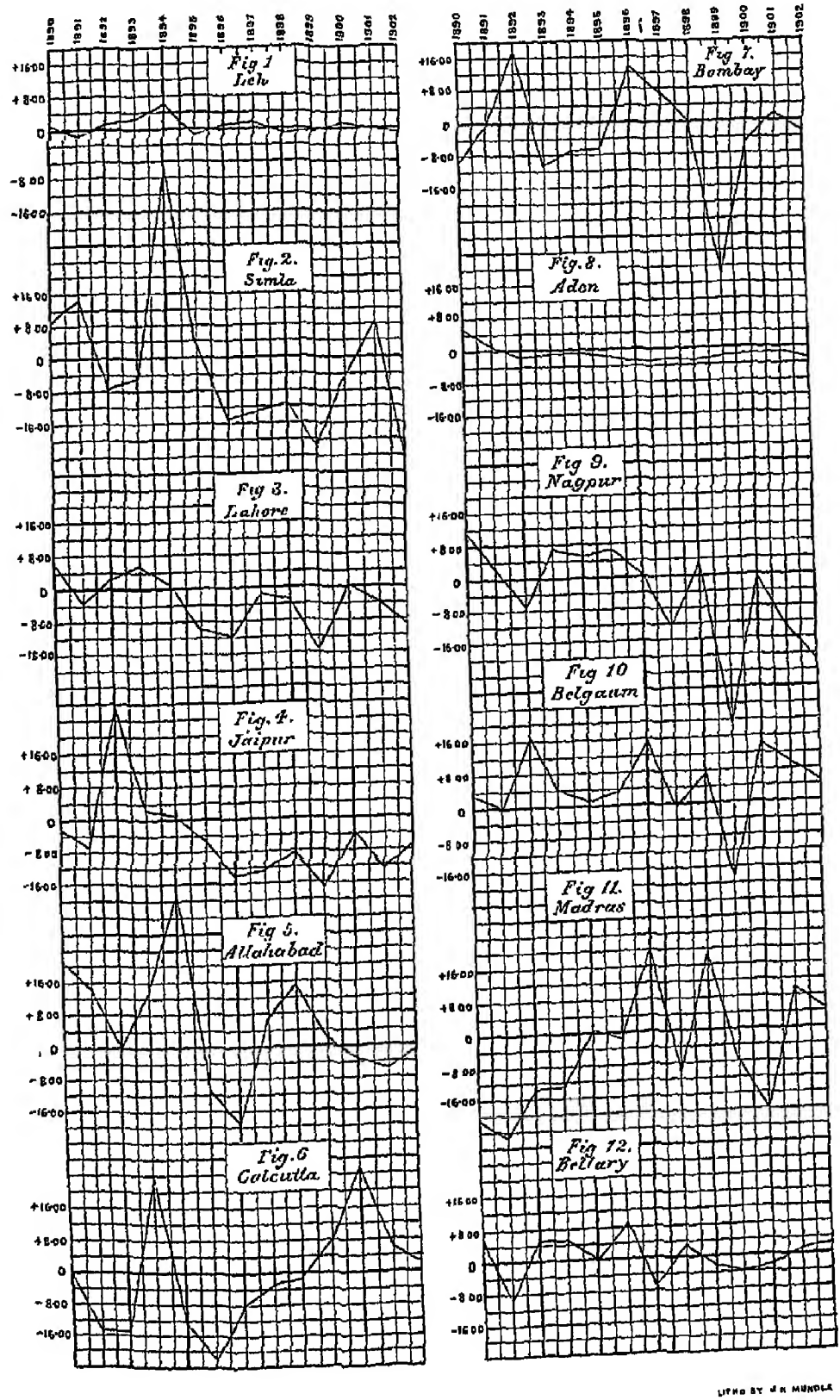
LITHO BY J.N.MUNDLE

SMOOTHED VARIATION FROM NORMAL OF MEAN ANNUAL RAINFALL AT TWELVE SELECTED AND REPRESENTATIVE STATIONS DURING THE PERIOD, 1890—1902.



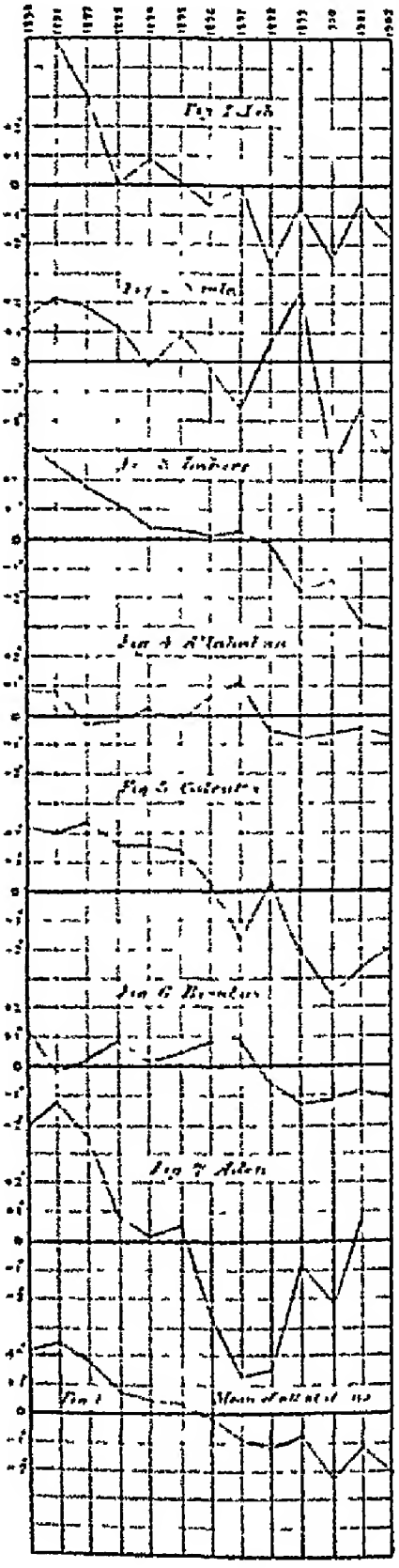
LITHO. BY J.R. MONDLE.

ACTUAL VARIATION FROM NORMAL OF MEAN ANNUAL RAINFALL AT TWELVE SELECTED AND REPRESENTATIVE STATIONS DURING THE PERIOD, 1890–1902.

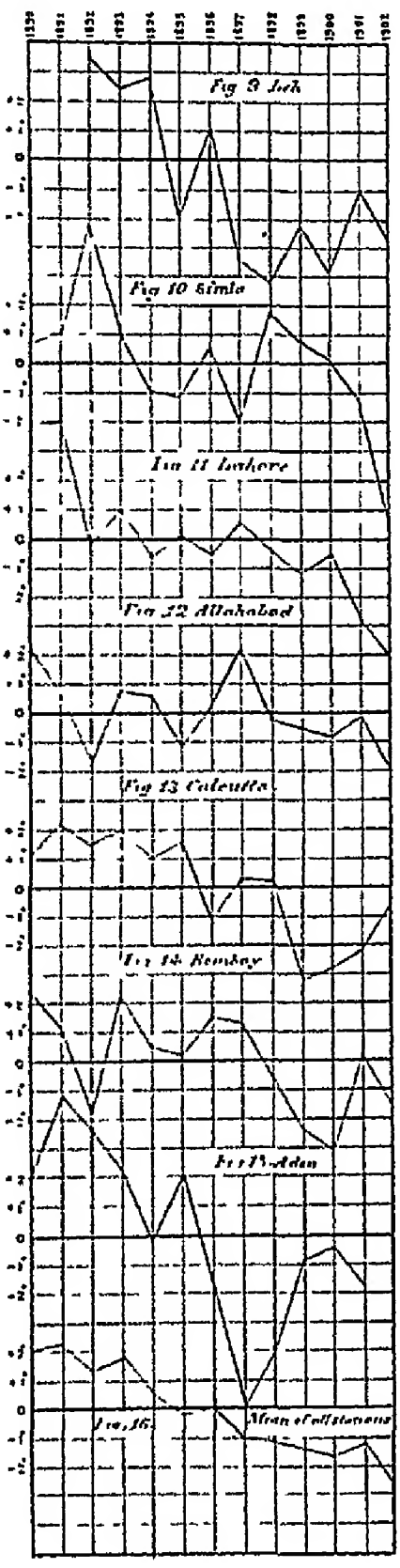


LITHO BY J.H. MUNDLE

ACTUAL VARIATION FROM NORMAL OF ANNUAL MEAN EXCESS OF SUN OVER SHADE TEMPERATURE 1891–1902

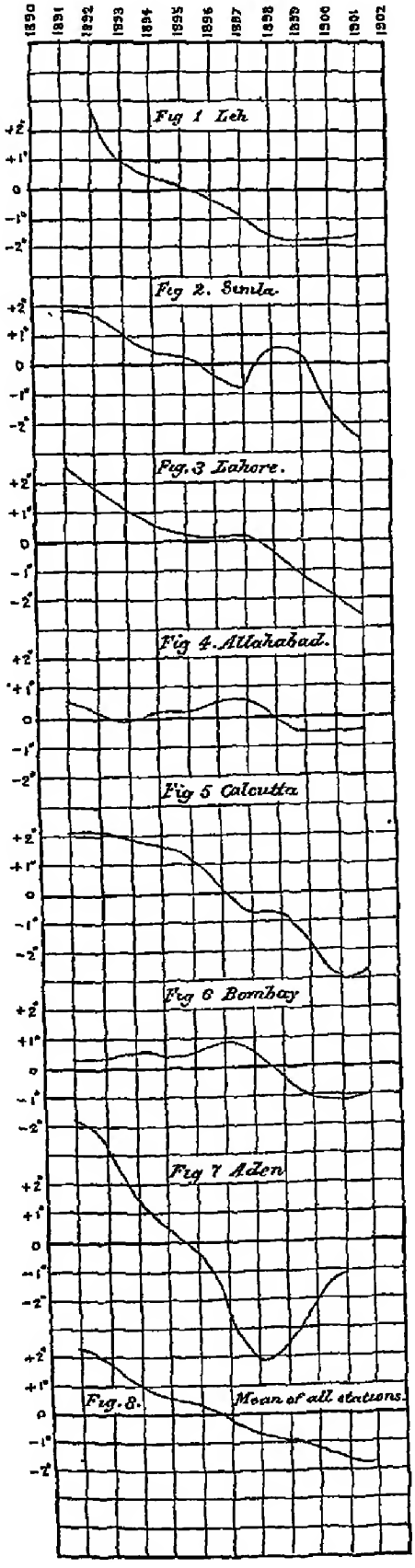


ACTUAL VARIATION FROM NORMAL OF MEAN EXCESS OF SUN OVER SHADE TEMPERATURE OF HOT-WEATHER PERIOD MARCH TO MAY, 1891–1902.

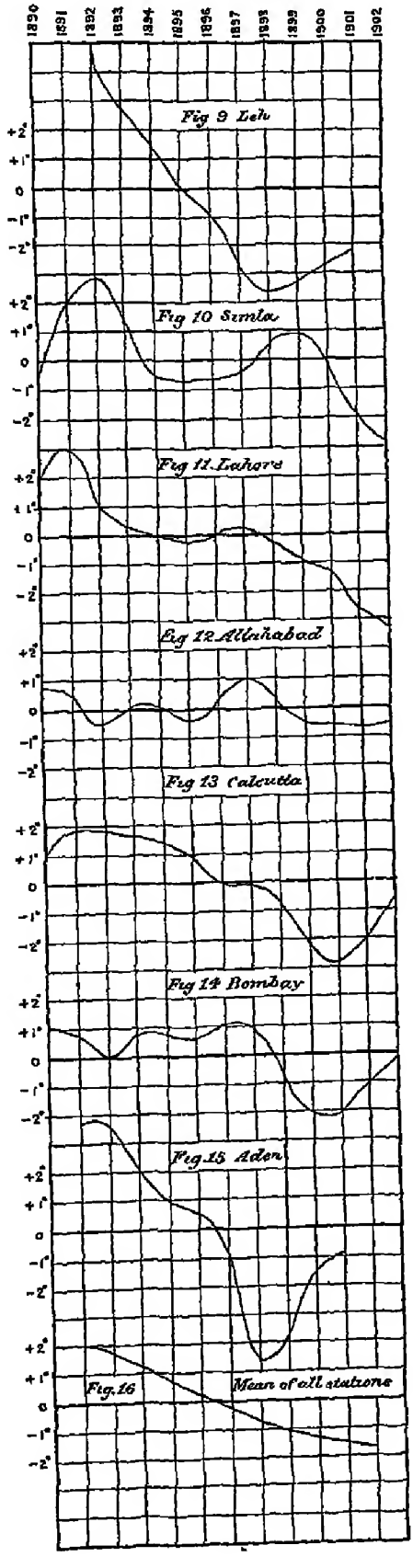


LITHO BY J N M HOLE.

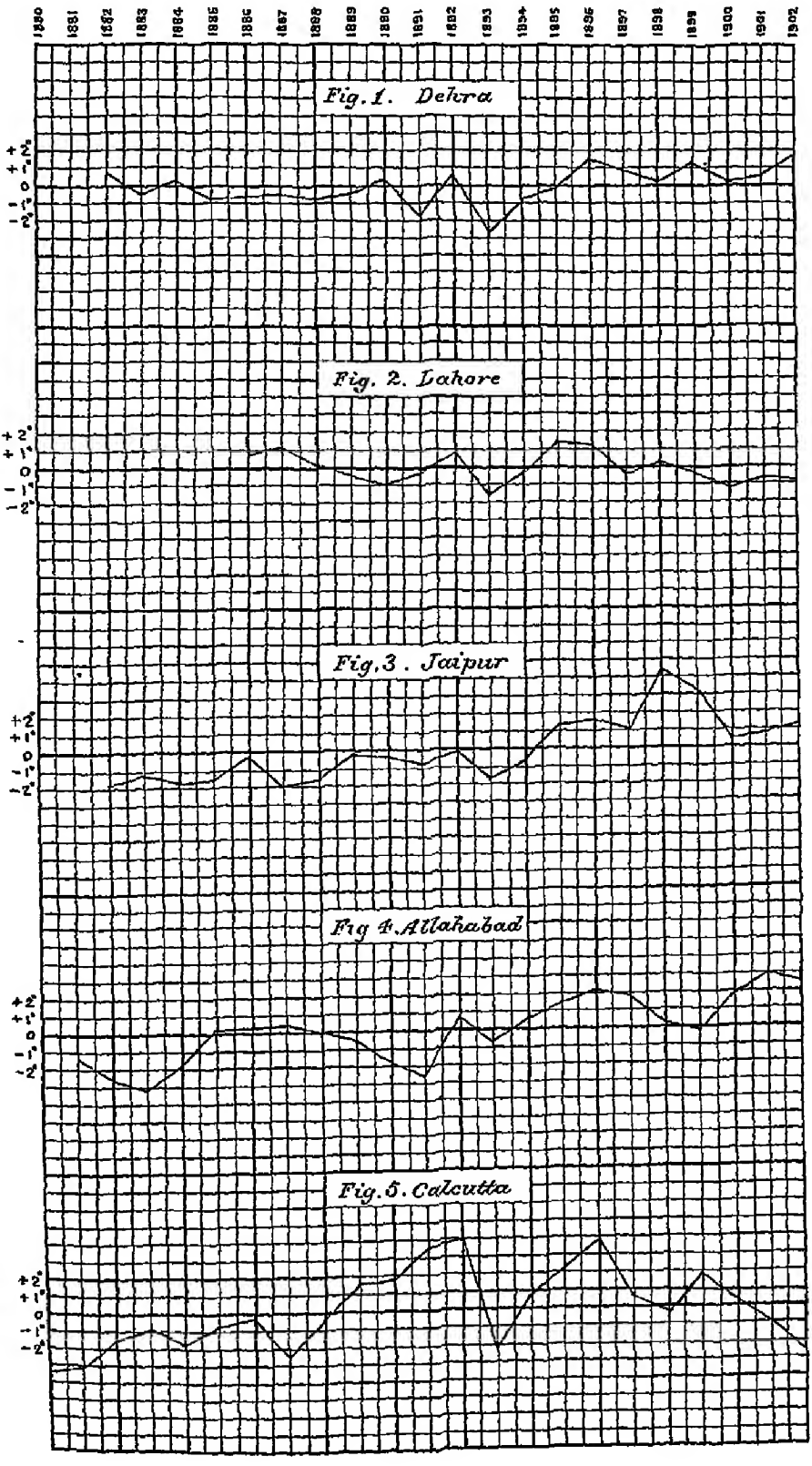
SMOOTHED VARIATION FROM NORMAL OF ANNUAL MEAN EXCESS OF SUN OVER SHADE TEMPERATURE, 1891–1902.



SMOOTHED VARIATION FROM NORMAL OF MEAN EXCESS OF SUN OVER SHADE TEMPERATURE OF HOT-WEATHER PERIOD MARCH TO MAY 1891–1902.

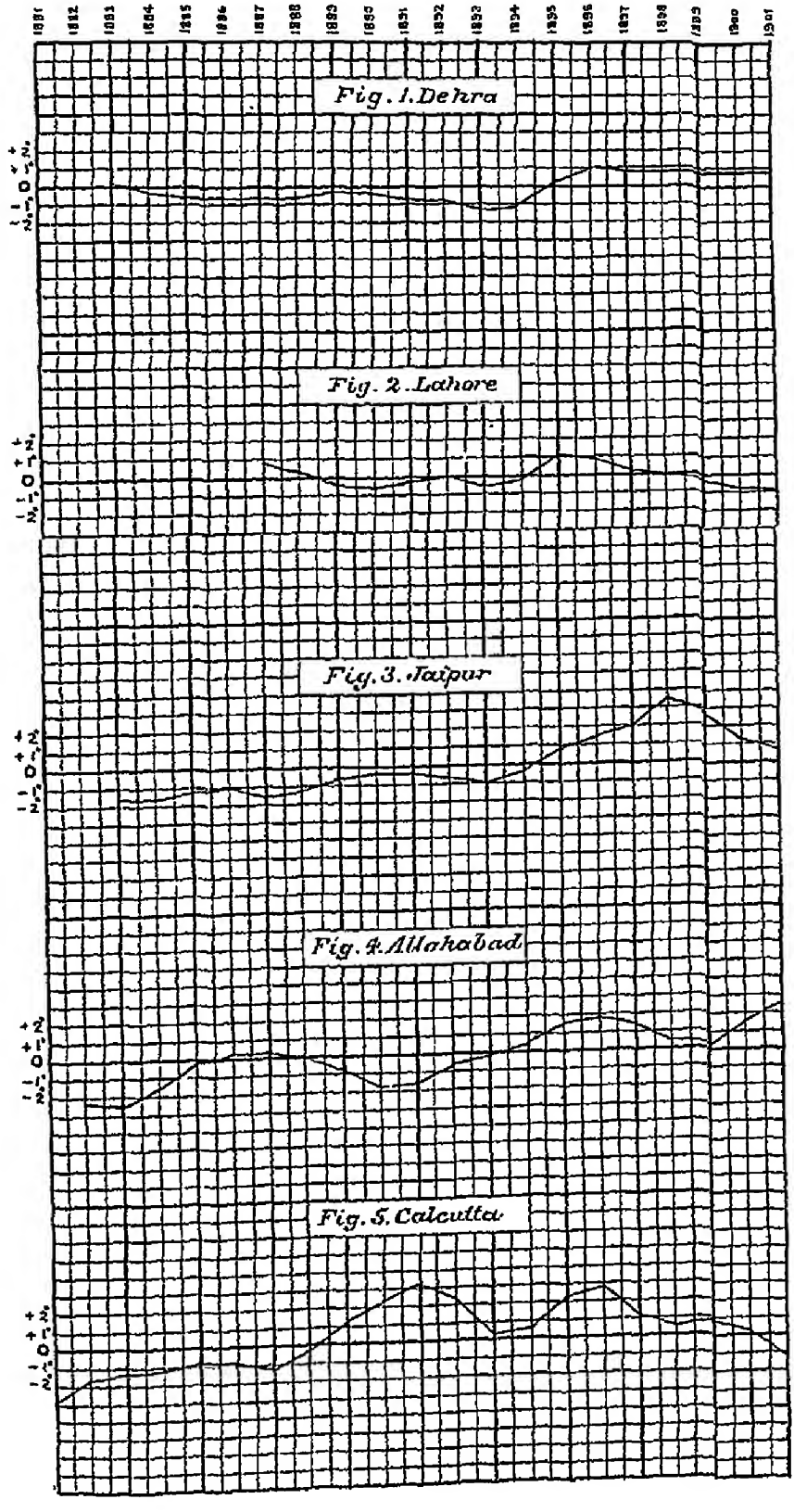


ACTUAL ANNUAL VARIATION OF GROUND SURFACE TEMPERATURE FROM NORMAL AT DEHRA, LAHORE, JAIPUR, ALLAHABAD AND CALCUTTA DURING PERIOD 1880–1902.



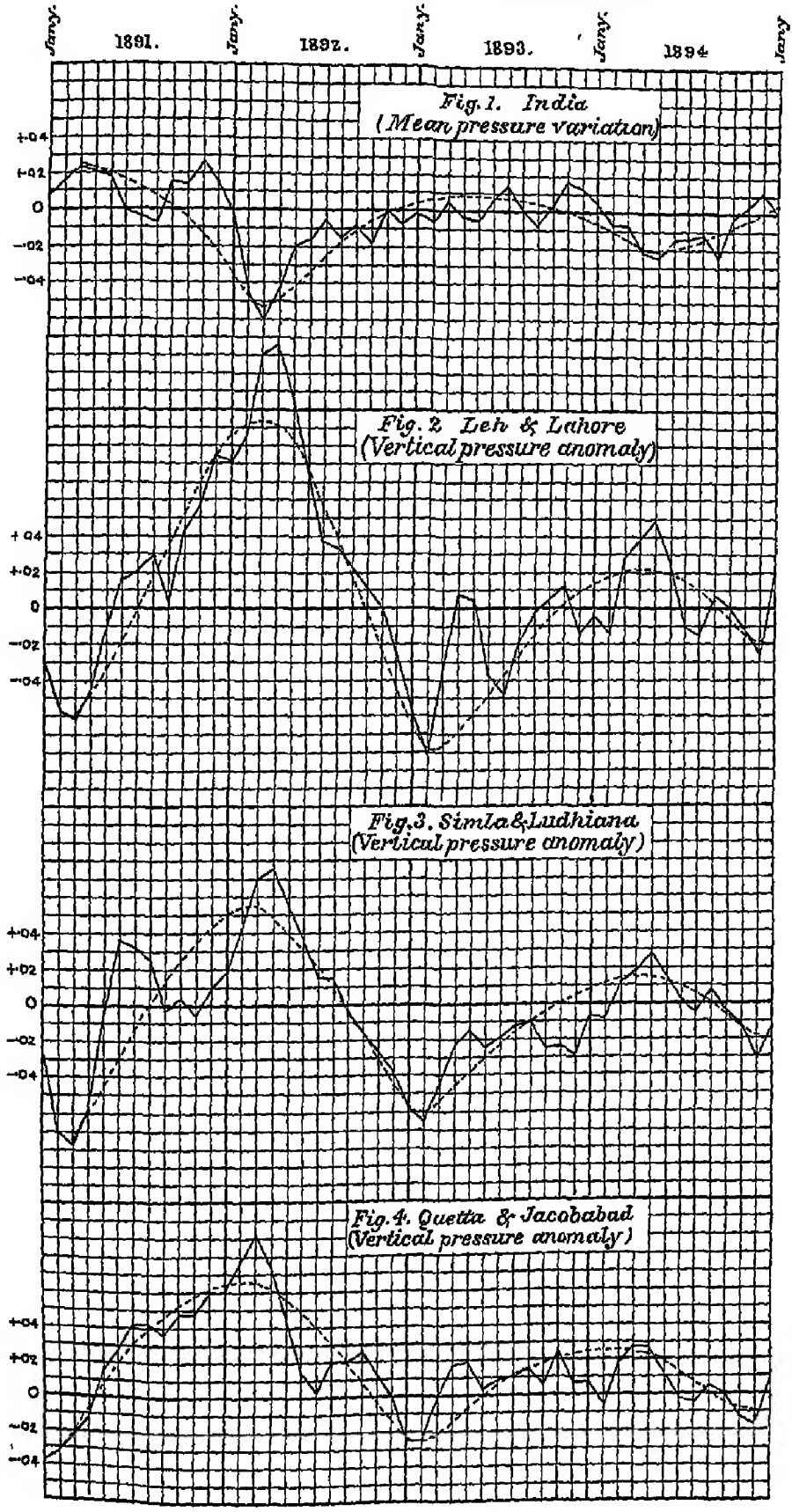
LITHO BY J N MUNDLE

SMOOTHED ANNUAL VARIATION OF GROUND SURFACE TEMPERATURE FROM NORMAL AT DEHRA, LAHORE, JAIPUR, ALLAHABAD AND CALCUTTA DURING PERIOD 1881-1901.

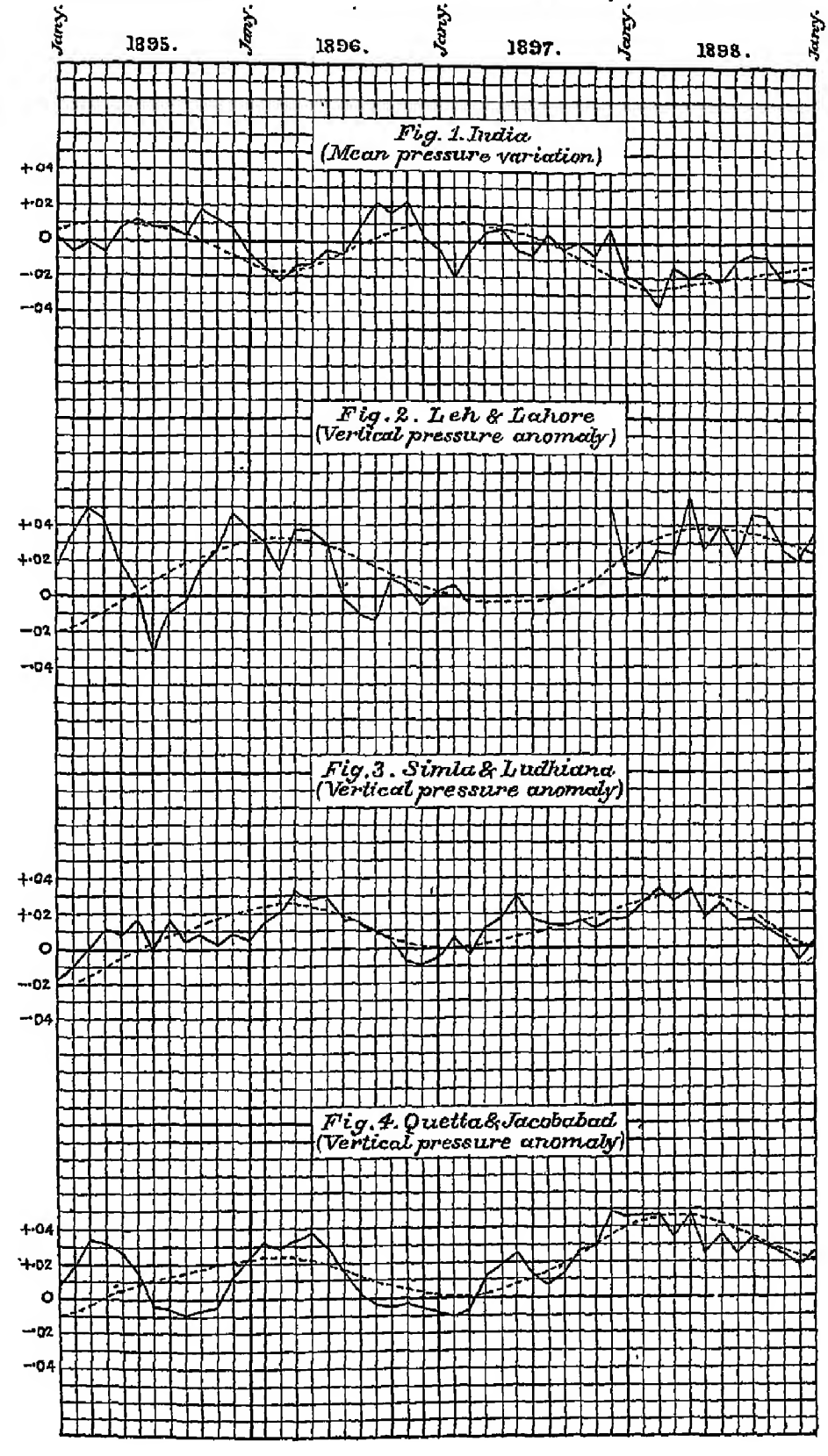


LITHO. BY J. N. MURDIA

SMOOTHED MONTHLY VARIATION FROM NORMAL OF PRESSURE OF THE INDIAN LAND AREA FROM JANUARY 1891 TO DECEMBER 1894 AND MONTHLY VERTICAL PRESSURE ANOMALIES FOR THREE PAIRS OF STATIONS IN NORTHERN INDIA, VIZ., LEH & LAHORE, SIMLA & LUDHIANA, AND QUETTA & JACOBABAD.

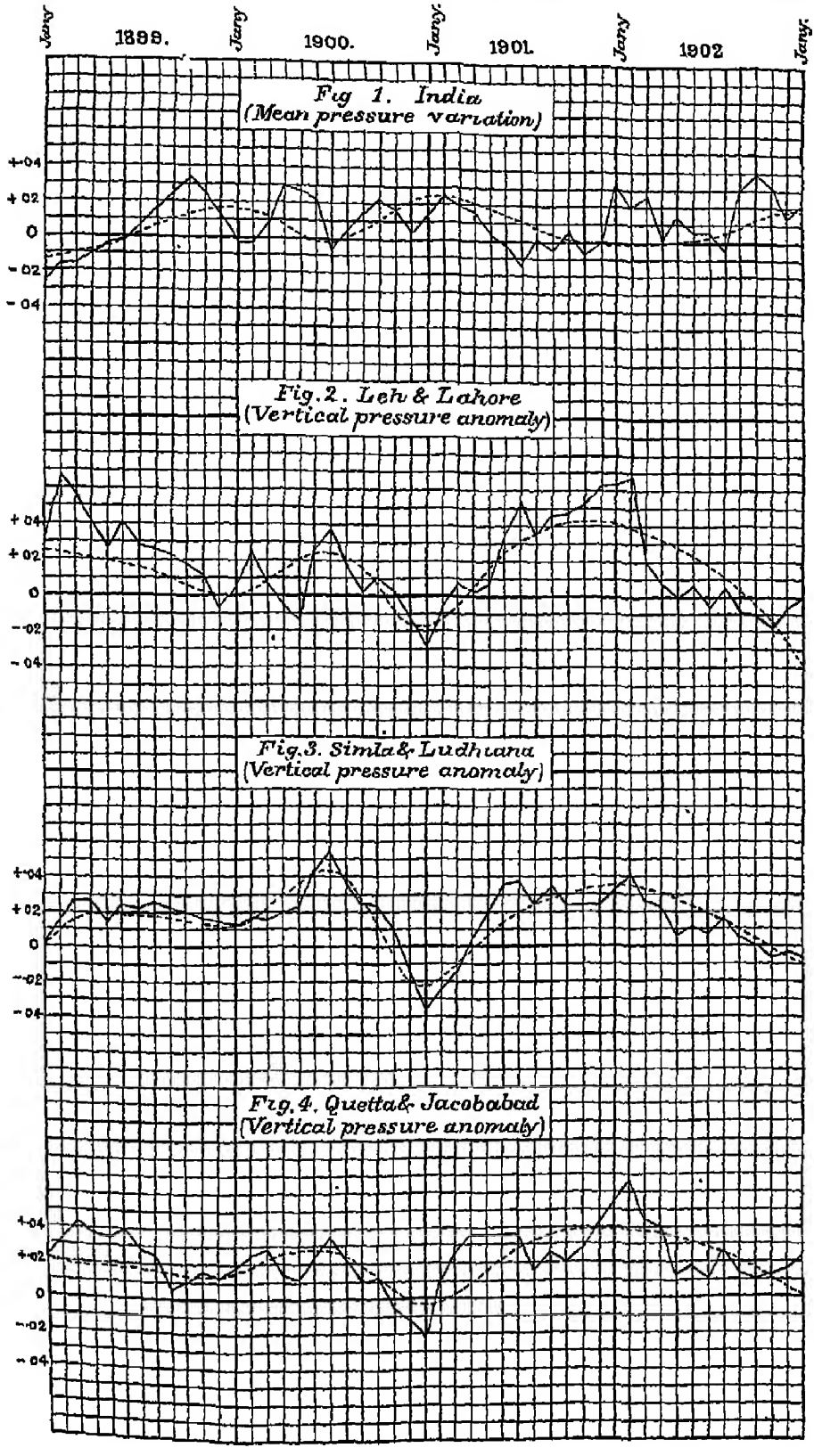


SMOOTHED MONTHLY VARIATION FROM NORMAL OF PRESSURE OF THE INDIAN LAND AREA, FROM JANUARY 1895 TO DECEMBER 1898 AND MONTHLY VERTICAL PRESSURE ANOMALIES FOR THREE PAIRS OF STATIONS IN NORTHERN INDIA, VIZ., LEH & LAHORE, SIMLA & LUDHIANA, AND QUETTA & JACOBABAD.

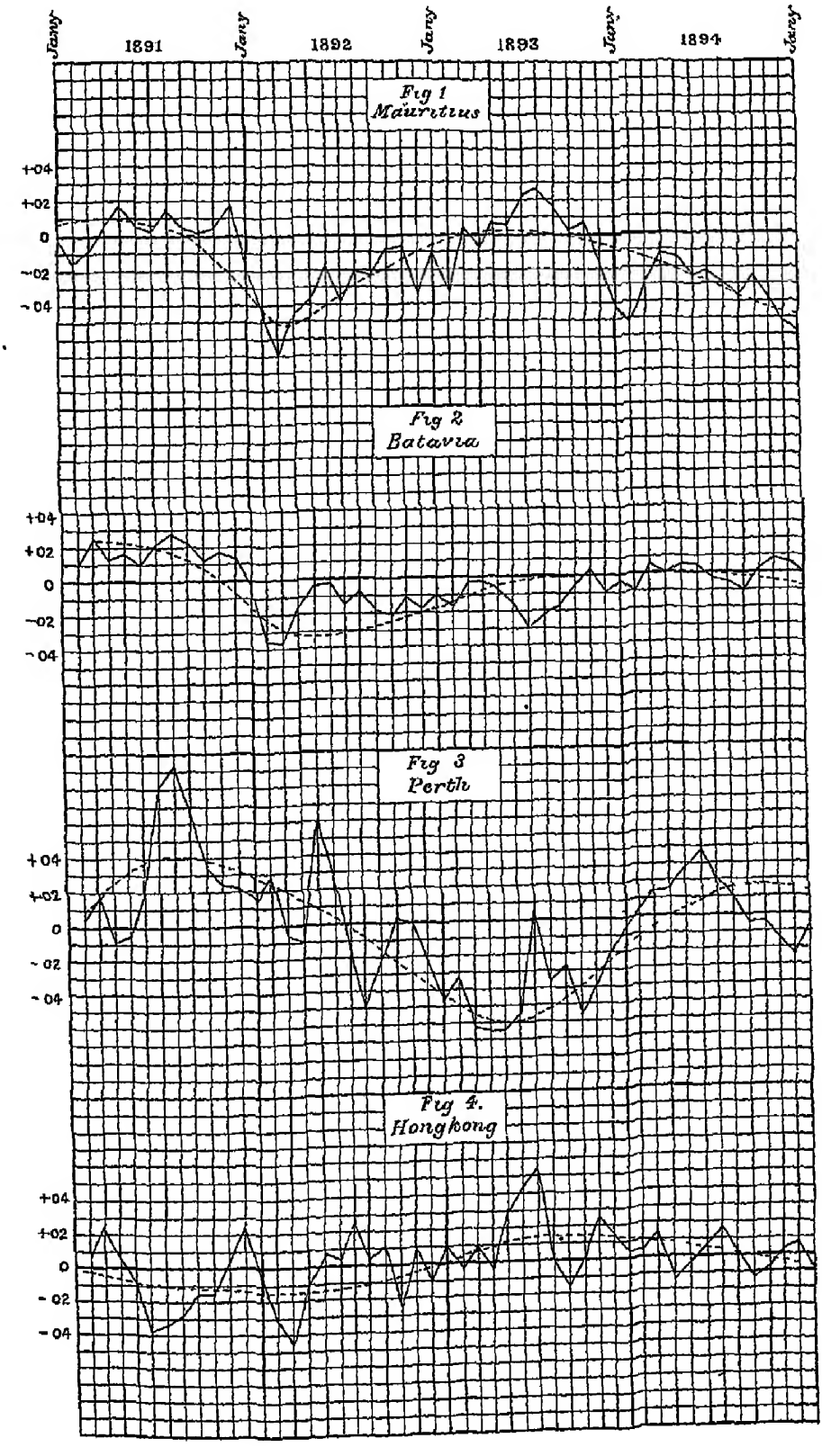


LITHO BY J.N. HUNDLE

SMOOTHED MONTHLY VARIATION FROM NORMAL OF PRESSURE OF THE INDIAN LAND AREA FROM JANUARY 1899 TO JANUARY 1903 AND MONTHLY VERTICAL PRESSURE ANOMALIES FOR THREE PAIRS OF STATIONS IN NORTHERN INDIA, VIZ., LEH & LAHORE, SIMLA & LUDHIANA, AND QUETTA & JACOBABAD

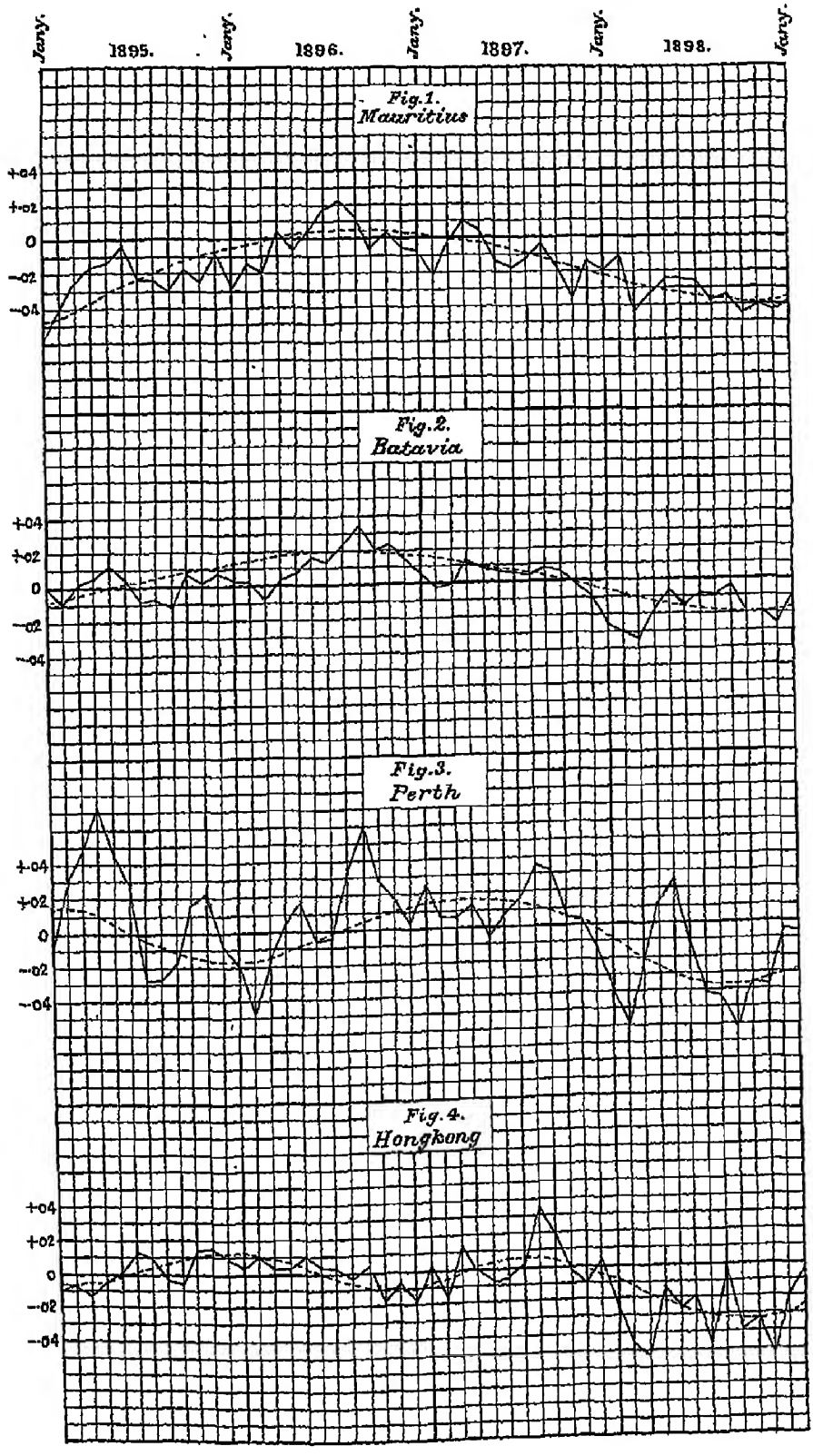


SMOOTHED VARIATION FROM NORMAL OF PRESSURE (MONTH BY MONTH) DURING THE PERIOD, 1891 TO 1894, AT MAURITIUS, BATAVIA, PERTH AND HONGKONG



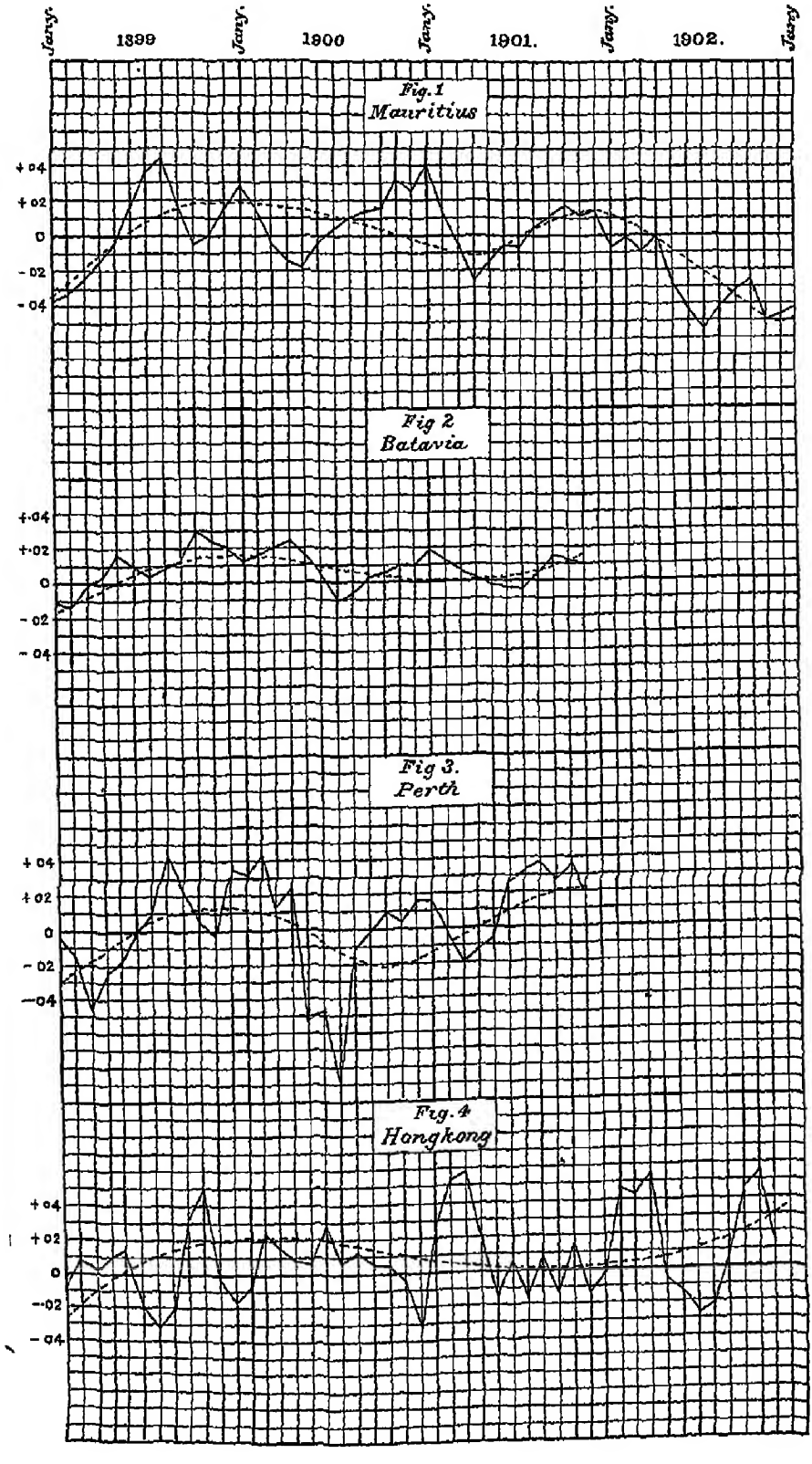
LITHO BY J.H. MUNDLE

SMOOTHED VARIATION FROM NORMAL OF PRESSURE (MONTH BY MONTH) DURING THE PERIOD, 1895 TO 1898 AT MAURITIUS, BATAVIA, PERTH AND HONGKONG.



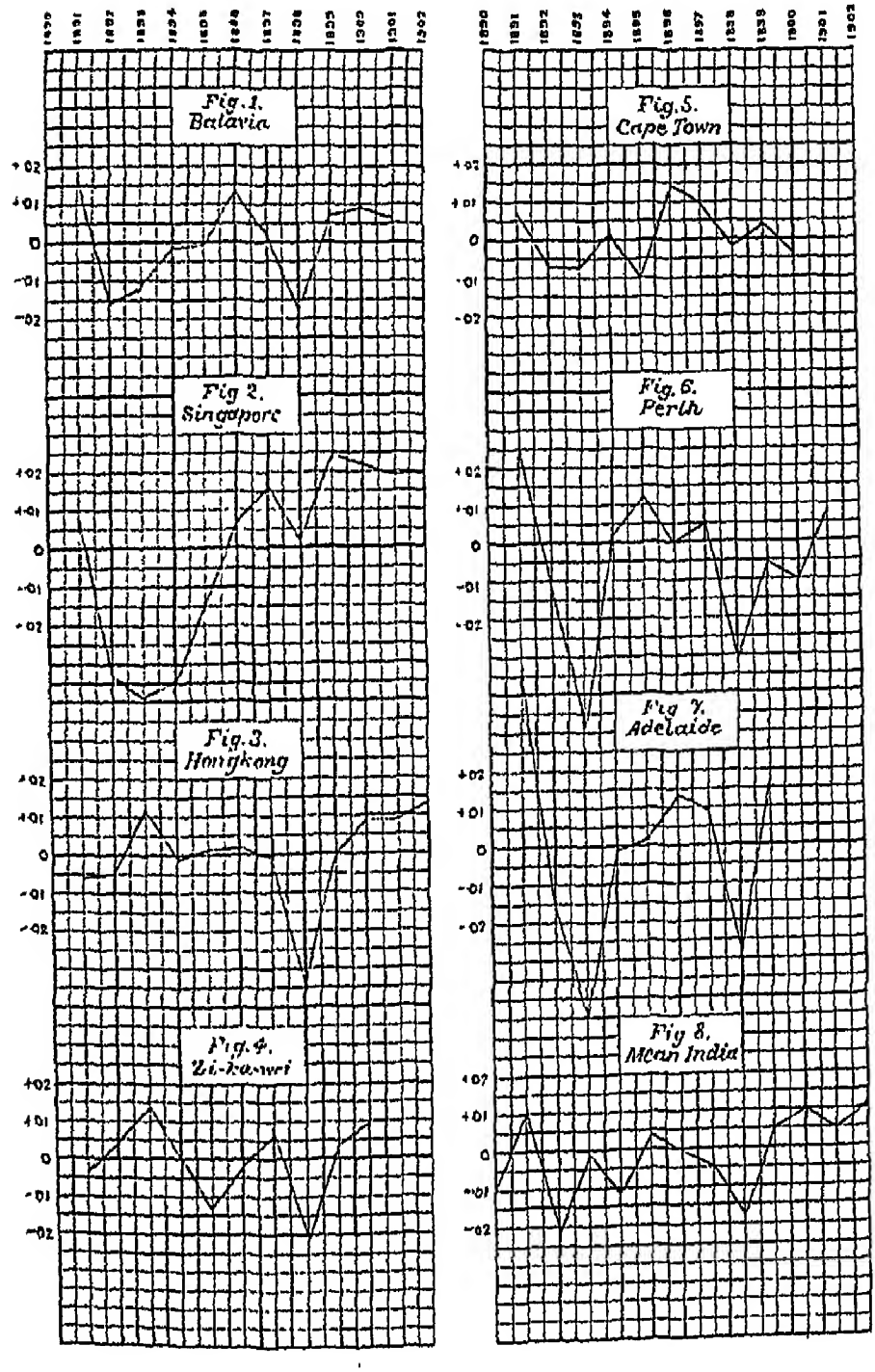
LITHO BY J.N. MUNDLE

SMOOTHED VARIATION FROM NORMAL OF PRESSURE (MONTH BY MONTH) DURING THE PERIOD, 1899 TO 1902, AT MAURITIUS, BATAVIA, PERTH AND HONGKONG



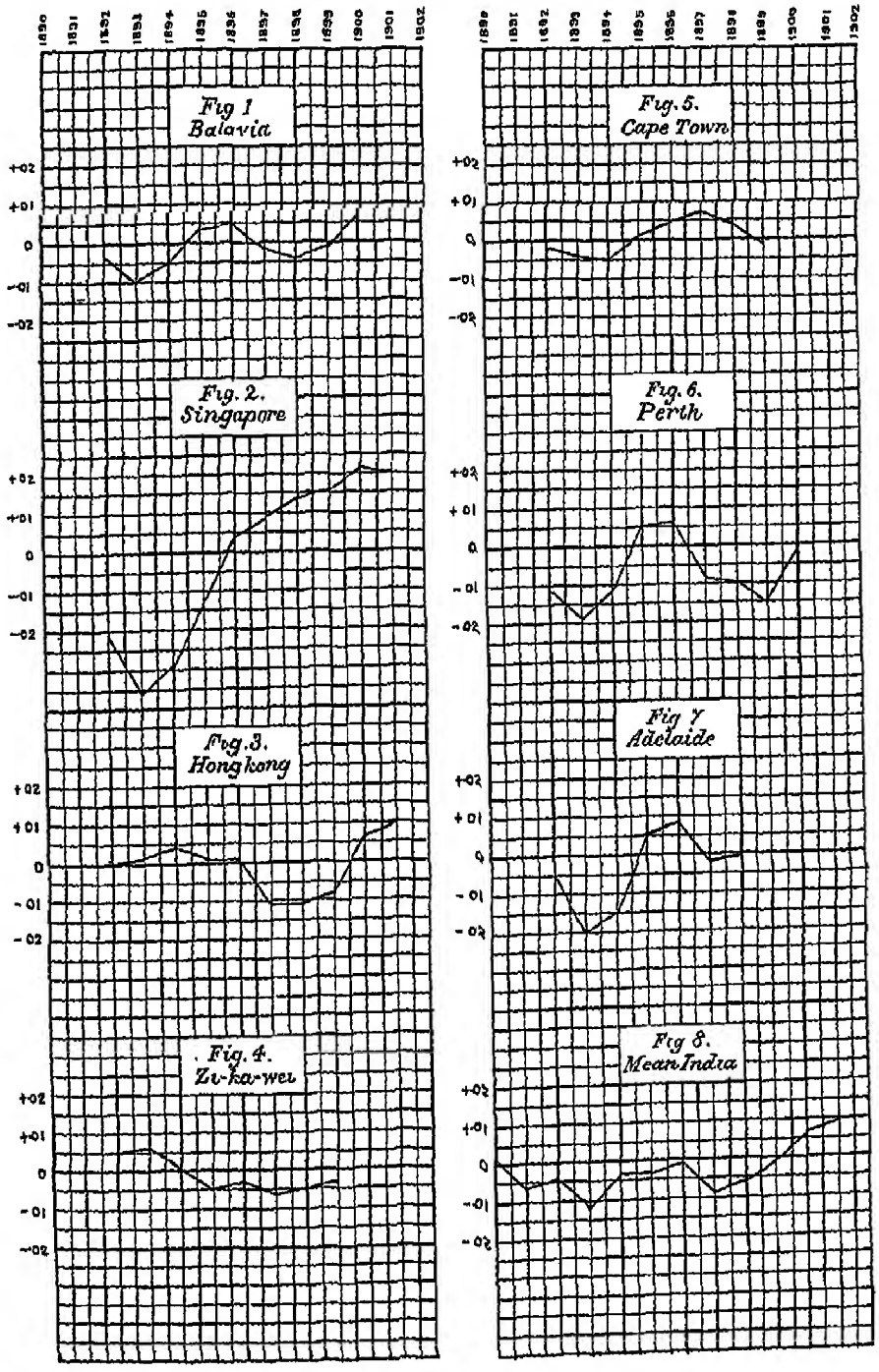
MTHS BY J N MUKERJI.

ACTUAL ANNUAL VARIATION OF PRESSURE AT SEVEN EXTRA-INDIAN STATIONS FROM 1891 TO 1902 TOGETHER WITH THAT OF MEAN INDIA.



LITHO. BY J. H. HUGHES.

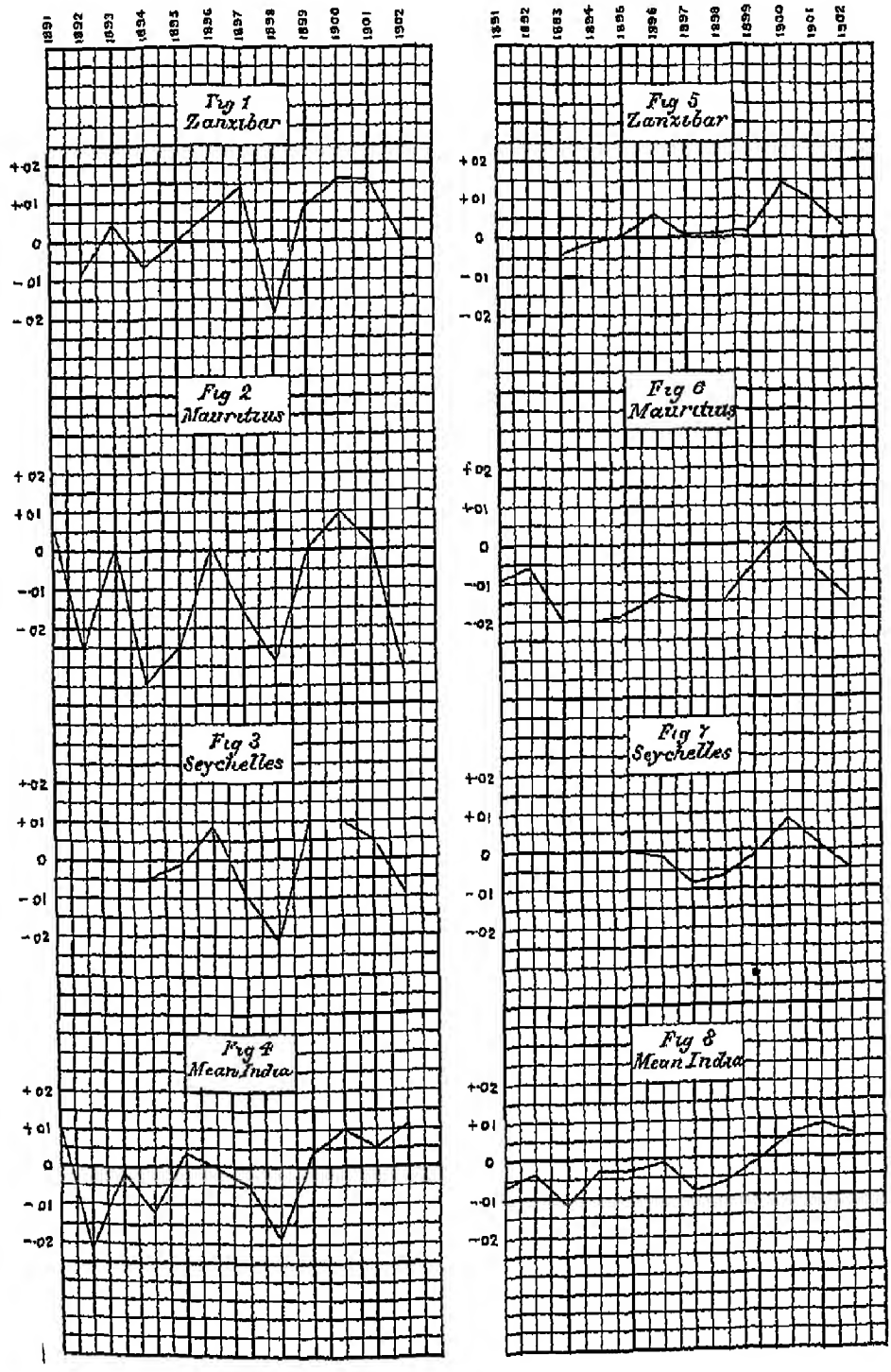
SMOOTHED ANNUAL VARIATION OF PRESSURE AT SEVEN EXTRA-INDIAN STATIONS FROM 1892 TO 1901 TOGETHER WITH THAT OF MEAN INDIA



LITHO BY J. N. MUNDLE

ACTUAL ANNUAL VARIATION OF PRESSURE FROM 1891 TO 1902 AT ZANZIBAR, MAURITIUS, SEYCHELLES AND MEAN INDIA

SMOOTHED ANNUAL VARIATION OF PRESSURE FROM 1891 TO 1902 AT ZANZIBAR, MAURITIUS, SEYCHELLES AND MEAN INDIA



LITHO BY J.A. MUNDLE